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CHEAPER ELECTRIC WIRING AND THE MANUFACTURERS OF STANDARD WIRING DEVICES.

The Biltmore Hotel, New York City, was the scene of one of the most animated and interesting meetings of electrical manufacturers of wiring devices that has ever been staged in the history of the electrical industry. They were there because word had gotten around that an innovation was threatened which, if carried out in the portentous proportions which its proponents claimed for it, would threaten a considerable portion of the industry with disaster.

Ever since the central-station companies of the country have undertaken an aggressive campaign to increase the utilization of electrical energy and current-consuming devices they have been confronted with the obstacle which has existed in the minds of many prospective customers, that the cost of installation was prohibitive. Apparently the only answer to this problem was to reduce the cost of wiring, although many organizations have made tremendous gains through proper efforts at salesmanship, and have indeed as the years have slipped by, not reverted to an inferior method of installation but have constantly increased the standards of practice. There are, however, many instances where if a cheap, easily installed and safe system of electrical wiring were available, the easy accretion of a considerable load would follow with a consequent general increase in the use of every form of current-consuming device.

With the idea in mind of discovering ways and means by which the use of electrical energy in current-consuming devices might be made available to many to whom it is now a luxury, the Committee on the Wiring of Existing Buildings of the National Electric Light Association has recently come to the conclusion that the introduction of a concentric system of wiring would do much to bring about this condition. Quite recently the Committee has indicated an active interest in the matter and it has become known that such a system is available and would be submitted for the approval of the Electrical Committee of the National Fire Protection Association when it holds its meeting in March next year. Subsequently this suggestion has received the endorsement of Mr. W. H. Blood, Jr., the insurance expert of the National Electric Light Association, and thereupon a bomb appears to have been thrown into the camp of the manufacturers of standard wiring devices.

The present provisions of the National Electrical Code, as we have pointed out before, have been developed in order that to as great a degree as possible the installation

of electrical apparatus and materials might be made safe. The Underwriters have demanded a continually improving standard of construction and the manufacturers of electrical apparatus, in conformity with the Code requirements, have responded in splendid fashion. We have available today electrical apparatus and materials of construction that have inspired a perfect public confidence in the utilization of electrical energy.

With many of the manufacturers of standard wiring devices, which have been produced in conformity with Code requirements, the apprehension is manifest that if a change is made practically the entire investment in the equipment for producing these standard devices will be wiped out. Consequently, the meeting at the Biltmore Hotel last Monday attracted about 150 manufacturers of these devices, together with electrical supply jobbers distributing these materials, and representative electrical contractors interested in the installation of such equipment. A report of this meeting is published on other pages of this issue. So far as we can judge the meeting has resulted in an airing of the question, in the formation of a representative committee to confer with the proponents of the concentric wiring scheme, and a suggestion for conservatism in adopting so radical a change in policy, and delay in putting such a change, if it were deemed expedient, into effect.

We may be prone to look upon the ethical side of the situation, and we have been accused of not being familiar enough with the practical issues involved. However, we do not believe that the innovation of a cheaper system of wiring is going to work the hardship upon the industry that so many believe will result. We believe thoroughly in the Code and its provisions, and until new rules are wisely made we endorse the slogan of the National Electrical Inspectors' Association: "Let the Code decide." It is exasperating, however, to realize that there might be a simpler method of handling many installations without reducing the factor of safety so that any element of hazard to life or property is involved, when a possible change in Code requirements might make a simpler system available. If such a system were found worthy of approval we confidently believe that it would be confined to those installations where the exigencies of the case demand that system only and none better. In England, where the concentric system has had considerable vogue, we find engineers not entirely in favor of it, and warmly endorsing our two-wire systems with their absolutely protective covering and very positive insurance against breakdown and hazard to life and property.

The time is short before the meeting of the Electrical Committee in March, but now that the subject has been opened up the opinions of those most vitally interested will have opportunity for public assimilation. Those representing the idea of less expensive interior wiring and those most interested in an expanding market for standard wiring devices are ably represented on the various committees that will be set at work. Whatever may be the outcome of the present agitation it may safely be presumed that the industry will be steered in the right direction.

PROGRESS IN CONTROL EQUIPMENT.

Without adequate control apparatus the successful use of electrical energy would be an impossibility, no matter how cheaply it could be generated and transmitted. Engineers occupied in other fields who take the trouble to study carefully the latest control equipment will be gratified to see how thoroughly the details of this important specialty are being worked out. Take charging equipment for electric vehicle batteries, upon the successful service of which often hinges the satisfaction of the truck or pleasure car user with his entire investment. The latest apparatus of this kind provides for safe handling by men entirely untrained in the knowledge of electricity, such as stevedores, shippers, teamsters, and other employees whose duties are not technical in any sense of the word. Such equipment in some of the most advanced designs provides that the circuit leading to the battery under charge cannot be closed unless all the resistance is between the battery and the line; that voltmeters and ammeters cannot be left in circuit continuously; that the charging circuit is not opened when manipulating the instrument-reading switch; and that simultaneous voltage and current readings shall be taken. There is a marked tendency toward placing every resistance close to the panel controlling its particular charging circuit and toward the concentration of switch handles and rheostat levers related to the same circuit in one area. The simplest forms of switch and rheostat handle, such as door knobs, are being used in many charging plants, and so far as possible it is being made just as free from complication for the employee as keen designing engineers can accomplish.

Apparatus details show a decided increase in refinement of design which insures reliability of operation and freedom from trouble. Thus, more attention is being paid to such apparent trifles as the design of cotter pins and the tapering of pin ends so as to facilitate quick assembly and easy adjustment. Contacts are being built up more and more on the unit plan, simply multiplying the units when increased current capacities are desired. Extended experiments have been conducted in the factory upon the wearing qualities of contact surfaces when breaking heavy currents, and the efficiency of copper leaves when assembled in wiping contacts has been studied with great care. The weaknesses of magnetic fields subjected to leakage, as related to positive switch operation, have been looked into with thoroughness, and designs made to do away with fluttering of contacts where the circuit conditions are unstable, or where lost motion gets into play in the equipment.

The best manufacturers are realizing that it pays to put their utmost efforts into quality. Had this not been done in a recent case, the purchaser would have had to rebuild an entire installation at enormous expense. It happened that at the last moment the duty on a resistance layout was doubled; every inch

of available space in the rheostat house was taken, and had the equipment failed to carry double its intended load, the necessary installation of larger units would have caused a complete alteration of plans for many outside structures only indirectly related to the resistances. The cost of purchasing high-class apparatus for current control is regarded by some users as an obstacle to the best-quality installations; but experience shows that the refinements now available in this kind of equipment are worth the cost in the long run where first-rate service is desired.

INTERMITTENT FLASHLIGHT SERVICE.

It has been calculated that the cost of a kilowatt-hour of energy developed in an ordinary pocket flashlight of the electric type somewhat exceeds $100, but the value of convenience is so great that these handy little appliances are increasing in popularity daily wherever electrical supplies are found. Their uses are almost beyond computation in variety, and scarcely anything has helped to popularize these devices more than the campaigns conducted by drug stores, department stores and other establishments close to the people whereby both batteries and lamps can be renewed at low cost.

With all the convenience of the modern flashlight equipped with the tungsten lamp of low candlepower, it is none the less desirable that the user shall learn how to make the most of his small investment, and to this end just a few words should be said about intermittent service. Many of the equipments now on the market are provided with a small sliding lock which cuts the lamp into continuous service, and in the abuse of this feature many users obtain short life from their batteries. Just as in the electric flashing sign the energy consumption is greatly reduced as compared with running the same connected load continuously for many hours, so the intermittent use of the pocket flashlight enormously conserves its capacity. Whether one employs such a lamp in picking a pathway through the woods, in going up and down stairs where local fixed lamps are not available, in hunting for names on door plates, going from one room to another to look at a clock, scanning dark suburban street signs, or countless other uses, short momentary contacts perform the service nearly as well as continued burning of the lamp, thanks to the power of the eye to adapt itself to changing conditions. Thus, in going down cellar in a place where there are no remote-controlled lamps, contacts of perhaps a half second's duration three or four seconds apart are often sufficient, and increase the length of life of the battery from six to eightfold. The cheaper any electrical service can be made, the more popular it is sure to become, and the makers of flashlights and other portable apparatus need not fear reduced sales if their products are used as efficiently as possible; for in this field, as in many others, the general public has far from absorbed the possible output of useful appliances which can be utilized at low total expense by intelligent handling.

THE RATE DECISION AND THE RETURN OF PROSPERITY.

The Interstate Commerce Commission has granted the five-per-cent increase in freight rates to the eastern railroads in official classification territory, with some reasonable exceptions with regard to the handling of coal and iron ore and in certain avenues of traffic of a technical description. For a considerable period the railroads of the country have found it expedient to delay purchases for the development of their traffic and for the rehabilitation of existing systems. The promise has been made time and time again that all that was necessary to bring back a condition of great prosperity to the country was to create a favorable market for the assimilation of railroad bonds and stock issues in order that the immense buying power of the railroads might be released.

Hardly anyone doubts the oft repeated statement that if the railroads buy only what they normally need their purchases will be very much in excess in 1915 over what they have bought for the last two or three years. If they go into the market for even a slight development of existing properties there will be created a considerable industrial activity in many lines of production. We believe that the railroads will buy and will buy liberally. They have, however, learned many lessons in conservatism and the effect of these recent studies will remain with the purchasing departments of these big institutions for some time to come.

It is hardly logical that the mere fact that even so extensive an industry as the railroads are in a more favorable position to execute a buying policy can materially effect a readjustment of business conditions. Permanent prosperity is not dependent upon a healthy impulse in a single direction.

The railroads of the country will be busy when the country is busy; when large numbers of people are traveling, and when a large volume of freight is being moved. Granted that these passengers may be carried and the freight may be moved at rates which will return a profit to the railroads, this larger return may be anticipated and the return to general prosperity quickened to just that degree.

The most significant phase of the rate increase is its assurance to the business interests of the country that the regulatory bodies recognize the right of investment to expect an adequate return, and the recognition that unless the free development of commerce is guaranteed, the country as a whole will find it hard to respond to any quickening influence whatsoever. At the close of what has been a mighty hard year, therefore, the increase in freight rates should act as a tonic. If it will mean the uplift of the business spirit of the country and an inspiration to go forward sturdily in the development of all business enterprises, it will be well worth the small extra burden that will be placed upon the shoulders of the ultimate consumer.

Commonwealth Edison Company Awarded Safety Medal.

The highest honor in the field of accident prevention has been conferred upon the Commonwealth Edison Company, of Chicago, by the American Museum of Safety for the work this company has done during the year in promoting industrial safety. The award is doubly significant because of the popular impression that the central-station business is among the most hazardous of any line of endeavor and because over 200 industrial corporations entered into the competition for the prize.

The token of victory is a gold medal of special design presented annually by the Travelers' Insurance Company. The award this year was made at the close of the Safety and Sanitation Conference, held in New York December 14 to 19, under the auspices of the American Museum of Safety, of which Arthur Williams is president. At this exposition displays were made by many of the companies contesting for the award, the exhibits covering photographs, diagrams and other data respecting accident prevention, sanitation and welfare work, all of which were considered in making the award.

Records exhibited by the Commonwealth Edison Company at the New York Exposition showed that the number of accidents per 100 employes had been reduced from 4.1 to 2.1. The average loss of time of this 2.1 per cent of the employees was 4.5 days per year. Seriousness of accidents has also greatly decreased as is indicated by figures showing that the time lost per employee per month on account of disability was reduced from 13 per cent of a day to 1.8 per cent.

In addition to providing all the mechanical safeguards known to science the Edison company has devoted considerable effort to educating the employee and gaining his co-operation in safety measures, and to this work is attributed the excellent record made during the year. A standing committee consisting of Peter Junkersfeld, chairman, W. L. Abbott, J. H. Goehst, George B. Foster, W. C. Berry, H. L. Gannett and the officers of the Commonwealth Edison Section of the National Electric Light Association has had charge of the safety work for the company, co-operating in this connection with the Bureau of Safety, of the Insull properties, of which Charles B. Scott is manager.

The Travelers' Insurance Company medal has in previous years been awarded to the following companies: 1910, United States Steel Corporation; 1911, Pennsylvania Railroad; 1912, New York Edison Company; 1913, New York Telephone Company.

Minneapolis Jovians Will Entertain.

The Minneapolis Jovian League announces a special entertainment for December 29. W. T. White, Minneapolis representative of the Cutter Electrical Company, Philadelphia, Pa., who is Tribune of the Minneapolis League, said no intimation is to be given in advance as to the nature of the program. But, as the meeting is to be the last in 1914, and the league is known for its resource in springing novelties, the membership confidently expect to be surprised. It is expected that this will be one of the most rousing meetings of the year.

The league is also arranging to entertain the thousand or more delegates who are expected to attend the annual convention of the National Association of Independent Telephone Companies in January. The Jovians will probably be hosts at a luncheon on one of the days of the meeting.

Meeting of Westinghouse Agent-Jobbers.

The midwinter meeting of the Westinghouse Agent-Jobbers was held at French Lick Springs, Ind., December 3, 4 and 5. Matters of mutual interest were discussed and the following officers elected: president, N. G. Harvey, Chicago, Ill.; vice-president, S. L. Nicholson, Pittsburgh, Pa.; secretary, Max McGraw, Sioux City, Ia.; assistant secretary, H. T. Pritchard, Pittsburgh, Pa.; treasurer, J. E. McClernon, New York, N. Y.

The object of the association is to promote close relations between the manufacturer and the agent-jobbers, with a view to providing more efficient avenues for distribution of electric appliances, and to popularize the use of electrical apparatus and supplies to the end that the purchase of such articles may be made easy and convenient for the ultimate user.

Chicago Section, Electric Vehicle Association.

F. E. McCall, of the Commonwealth Edison Company, spoke on the subject of "Power Rates," at the meeting of the Chicago Section, Electric Vehicle Association of America, on December 22. He referred particularly to the off-peak garage rate which is practically 25 per cent less than the wholesale power rate of the company. This rate has been an important factor in vehicle development in Chicago. It was shown to be lower than the rate in any other large city in the country.

A report was presented at the meeting comprising statements from a large number of electric passenger car garages indicating their willingness to accommodate commercial cars.

Electric Club of Chicago.

J. J. Arnold, vice-president of the First National Bank, Chicago, was the principal speaker at the meeting of the Electric Club of Chicago on December 17. He called attention to the inadequate banking system in vogue in this country, previous to the passage of the new Federal Reserve Act, and made comparisons with European practice. There were three principal features of the old system which were particularly antiquated and limiting, which have been only partially remedied by recent legislation. These are the regulation providing for a fixed reserve, which is useless in times of stringency, the duplication of deposits between banks, and the issuance of national bank notes on the bonds of the nation only.

Mr. Arnold said that the new law is fundamentally correct, but it does not entirely fulfill the needs of the country. He explained that the popular impression gained from newspaper accounts that the new law would improve business conditions is wrong, as elastic currency can only prevent panics and help when business is already good. He emphasized the fact that "tight" money reflects great business activity, while "easy" money encourages speculation.

Preceding Mr. Arnold's address remarks were made by S. B. Joseph, a banker of Buenos Aires, and W. H. Lough, of the U. S. Department of Foreign and Domestic Commerce. Mr. Joseph commented on the opportunities of American manufacturers to secure business in South America, but thought that this must be obtained on a reciprocal basis. South America needs capital and if American money is invested in the industries there, American manufacturers will receive the business of the country. He said the securities of the country are ample and the interest paid is high. Mr. Lough spoke along the same general lines urging, however, that money first be invested in our own industries.

William M. Connelly, a former secretary of the Club and now a resident of Spring Lake, Mich., spoke briefly at the close of Mr. Arnold's address.

H. A. Mott was appointed chairman of a special entertainment committee to provide for the annual meeting of the Club, to be held at the Hotel La Salle, January 7.

Chicago Jovian League.

H. N. Foster, traffic superintendent of the Chicago Telephone Company, delivered a very interesting address before the Chicago Jovian League on December 20, dealing with telephone traffic in the city. About 3,000,000 calls are handled daily and stereopticon slides were shown illustrating the equipment necessary to handle this volume of business. Many views were also shown of the exchanges, plants and equipment of the company.

Electrification of Chicago, Milwaukee & St. Paul Railway.

This illustrated article describes accurately the electrification work on the Puget Sound line of the Chicago, Milwaukee & St. Paul Railway. This electrification is without doubt the most important and extensive ever undertaken in the United States. For the first time in steam-road electrification, 3,000 volts, direct current, will be used and the locomotives are more powerful than any other steam or electric locomotives ever built.

Plans for the electrification of the first engine division of the Chicago, Milwaukee & Puget Sound Railway have now been completed and contracts let to the General Electric Company for the electric locomotives, substation apparatus and line material, and to the Montana Power Company for the construction of the transmission and trolley lines. This initial electrification of 113 miles of main line between Three Forks and Deer Lodge is the first step toward the electrification of four engine divisions extending from Harlowton, Mont., to Avery, Idaho, a total distance of approximately 440 miles, aggregating about 650 miles of track including yards and sidings. While this comprises the extent of track to be equipped in the near future, it is understood that plans are being made to extend the electrification from Harlowton to the coast, a distance of 850 miles, should the operating results of the initial installation prove as satisfactory as anticipated.

The plans of the Chicago, Milwaukee & St. Paul Railway are of especial interest, as this is the first attempt to install and operate electric locomotives on tracks extending over several engine divisions, under which conditions it is claimed the full advantage of electrification can be secured. The various terminal and tunnel installations have been made necessary, more or less, by reason of local conditions; but the electrification of this road is undertaken purely on economic grounds with the expectation that superior operating results with electric locomotives will effect a sufficient reduction in the present cost of steam operation to return an attractive percentage on the large investment required. If the anticipated savings are realized in the electric operation of the road, this initial installation will constitute one of the most important milestones in electric railway progress, and it should foreshadow large future developments in heavy steam-road electrification. The success of electric operation on such a large scale will, at least, settle the engineering and economic questions that enter into the advisability of making such an installation, and will limit similar future problems to the means of raising the money expenditure required.

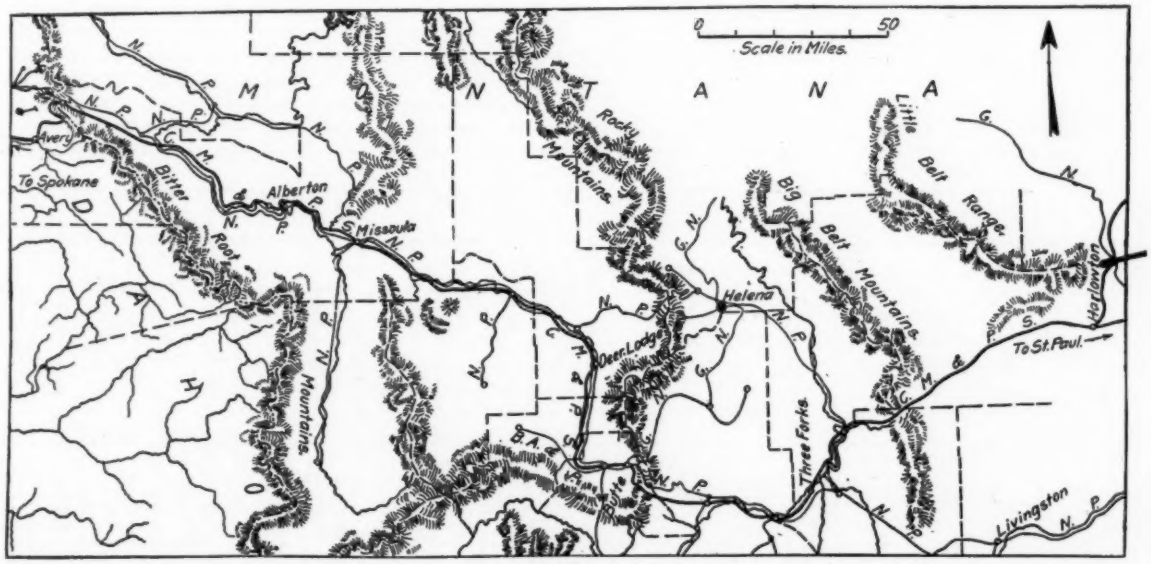
The first step taken towards electrification by the Chicago, Milwaukee & St. Paul Railway was to enter into a contract with the Montana Power Company for an adequate supply of power over the 440 miles of main line considered for immediate electrification. The precautions taken both by the railway company and power company to safeguard the continuity of power supply should guarantee a reliable source of power subject to few interruptions of a momentary nature only.

The Montana Power Company covers a great part of Montana and part of Idaho with its network of transmission lines, which are fed from a number of sources, of which the principal ones are tabulated herewith.

	Kilowatts
Madison River	11,000
Canyon Ferry	7,500
Hauser Lake	14,000
Big Hole	3,000
Butte, steam turbine	5,000
Rainbow Falls	21,000
Small powers aggregating	7,390
Total power developed	68,890

Further developments, part of which are under construction, are as follows:

	Kilowatts
Great Falls	85,000
Holter	30,000
Thompson Falls	30,000
Snake River	20,000
Missoula River	10,000
Total	175,000



Map of the Divisions of the Chicago, Milwaukee & Puget Sound Railway to be Electrified.

Total power capacity developed and undeveloped—244,000 kilowatts.

The several power sites are interconnected by transmission lines, supported on wooden poles and operating at 50,000 volts for the earlier installations, and on steel towers and operating at 100,000 volts for later installations. Ample water-storage capacity is provided in the Hebgen reservoir of 300,000 acre-feet, supplemented by an auxiliary reservoir capacity at the several power sites, which brings the total up to 418,000 acre-feet. The Hebgen reservoir is so located at the head waters of the Madison River that water drawn from it can supply in turn the several installations on the Madison and Missouri Rivers, so that the same storage capacity is used a number of

times, affording an available storage capacity considerably greater than is indicated by the figures given. It would seem, therefore, in changing from coal to electricity as a source of motive power, that the railroad is amply protected in respect to the reliability and continuity of the power supply.

Due to the great facilities available and the low cost of construction under the favorable conditions existing, the railway company will purchase power at a contract rate of $0.00536 per kilowatt-hour based on a 60-per-cent load-factor. It is expected under these conditions that the cost of power for locomotives will be considerably less than is now expended for coal. The contract between the railway and power companies provides that the total electrification between Harlowton and Avery, comprising four engine divisions, will be in operation January 1, 1918.

In order to connect the substations with the several feeding-in points of the Montana Power transmission lines, a tie-in transmission line is being built by the railway company that will permit feeding each substation from two directions and from two or more sources of power. This transmission line will be constructed with wooden poles, suspension-type insulators, will operate at 100,000 volts and will follow, in general, the right of way of the railway company except where advantage can be taken of a shorter route over public domain to avoid the necessary circuitous line of the railway in the mountain districts.

The immediate electrification of 113 miles will include four substations containing step-down transformers and motor-generator sets with necessary controlling switchboard apparatus to convert 100,000-volt, 60-cycle, three-phase power to 3,000 volts direct current. This is the first direct-current installation using such a high potential as 3,000 volts, and this system was adopted in preference to all others after a careful investigation extending over two years. The 2,400-volt direct-current installation of the Butte, Anaconda & Pacific Railway in the immediate territory of the proposed Chicago, Milwaukee & Puget Sound electrification has furnished an excellent demonstration of high-voltage, direct-current locomotive operation during the past year and a half, and the selection of 3,000 volts direct current for the Chicago, Milwaukee & Puget Sound was due in a large measure to the entirely satisfactory performance of the Butte, Anaconda & Pacific installation.

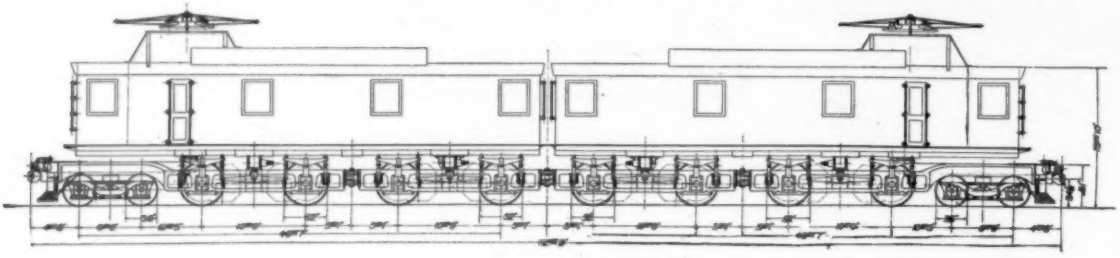
The equipment for this road was also furnished by the General Electric Company, and a comparison based on six months' steam and electric operation shows a total net saving of more than 20 per cent on the investment or total cost of the electrification. These figures, of course, do not take into account the increased capacity of the lines, improvement to the service and the more regular working hours for the crews. The comparison also shows that the tonnage per train has been increased by 35 per cent, while the number of trains has been decreased by 25 per cent with a saving of 27 per cent in the time required per trip.

Substations.

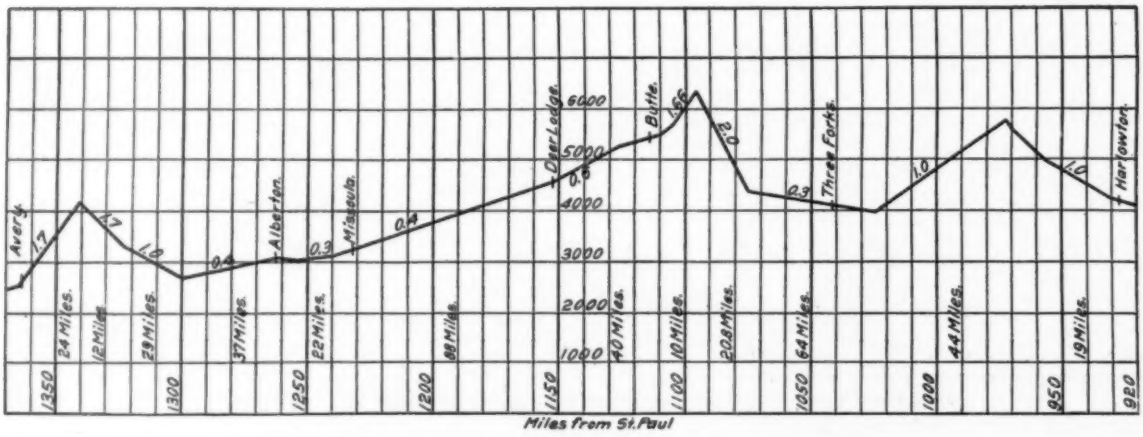
The substation sites of the Chicago, Milwaukee & Puget Sound electrified zone provide for an average intervening distance of approximately 35 miles, notwithstanding that the first installation embraces 20.8 miles of two-per-cent grade westbound and 10.4 miles of 1.66-per-cent grade eastbound over the main range of the Rocky Mountains. With this extreme distance between substations and considering the heavy traffic and small amount of feeder copper to be installed, it becomes apparent that such a high potential as 3,000 volts direct current permits of a minimum investment in substation apparatus and considerable latitude as to location sites.

The substations will be of the indoor type, transformers being three-phase, oil-cooled, and reducing from 100,000 volts primary to 2,300 volts secondary, at which potential the synchronous motors will operate. The transformers will be rated 1,900 and 2,500 kilovolt-amperes and will be provided with four 2.5-per-cent taps in the primary and 50-per-cent starting taps in the secondary.

The motor-generator sets will comprise a 60-cycle synchronous motor driv-



Outline of 3,000-Volt Direct-Current Electric Locomotive for the Chicago, Milwaukee & Puget Sound Railway.



Profile of the Present and Proposed Electrified Divisions Showing Elevation.

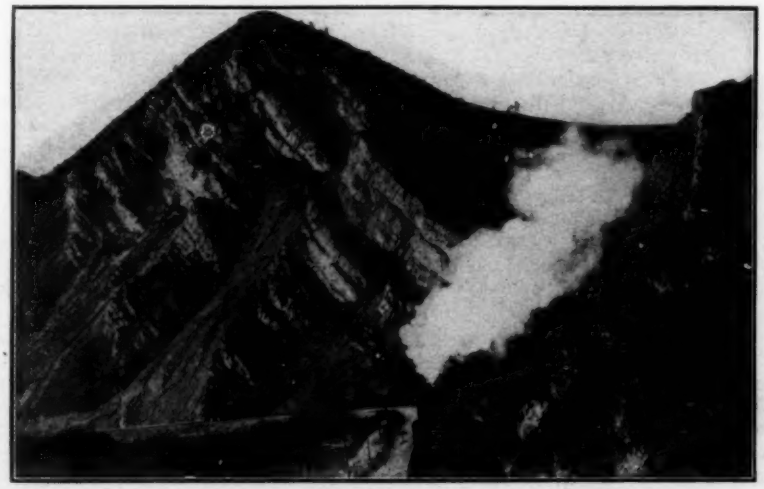
Section of Right-of-Way Through Bitter Root Mountains Which is to be Electrified.

ing two 1,500-volt direct-current generators connected permanently in series for 3,000 volts. The fields of both the synchronous motor and direct-current generators will be separately excited by small generators direct-connected to each end of the motor-generator shaft. The direct-current generators will be compound wound, will maintain constant potential up to 150-per-cent load and will have a capacity for momentary overloads up to three times their normal rating. To insure good commutation on these overloads, the generators are equipped with commutating poles and compensating pole-face windings. The synchronous motors will also be utilized as synchronous condensers, and it is expected that the transmission-line voltage can be so regulated thereby as to el minated any effect of the fluctuating railway load.

Overhead Construction.

The trolley construction will be of the catenary type, in which a 4/0 trolley wire is flexibly suspended from a steel catenary supported on wooden poles, the construction being bracket wherever track alinement will permit and cross-span on the sharper curves and in yards. Steel supports instead of wooden poles will be used in yards where the number of tracks to be spanned exceeds the possibilities of wooden-pole construction. Poles for the first installation are already on the ground and thirty miles of poles are set. Work in this direction will be pushed with all speed and will be completed in the summer of 1915, ready for operation in the fall on the delivery of the first locomotives.

As the result of careful investigation and experiments, a novel construction of trolley will be installed, composed of the so-called twin-conductor trolley. This comprises two 4/0 wires suspended side by side from the same catenary by independent hangers alternately connected to each trolley wire. This form of construction permits the collection of very heavy current by reason of the twin contact of the pantograph with the two trolley wires, and also insures sparkless collection under the extremes of either heavy current at low speed or more moderate current at very high speeds. It seems that the twin-conductor type of construction is equally adapted to the heavy grades calling for the collection of very heavy currents, and on the more level portions of the profile where maximum speeds of 60 miles per hour will be reached with the passenger trains having a total weight of over 1,000 tons. The advantage of this type of construction is due partly to the greater surface for the collection of current, but largely to the very great flexibility of the alternately suspended trolley wires, a form of construction which eliminates any tendency to flash at the hangers either at low or high speed. Including sidings, passing and yard tracks, the 113 miles of route mileage is increased to approximately 168 miles of single track to be equipped between Deer Lodge and Three Forks in the initial installation.



Section of Track Through Jefferson Valley to be Electrified.

Locomotives.

The locomotives to be manufactured by the General Electric Company are of especial interest for many reasons. They are the first locomotives to be constructed for railroad service with direct-current motors designed for so high a potential as 3,000 volts. They will weigh approximately 260 tons and will have a continuous capacity greater than any steam or electric locomotive yet constructed. Perhaps the most interesting part of the equipment is the control, which is arranged to effect regenerative electric braking on down grades. This feature as yet has never been accomplished with direct-current motors on so large a scale. The general characteristics as proposed are tabulated below:

Total weight	260	tons
Weight on drivers	200	tons
Weight on each guiding truck	30	tons
Number of driving axles	8	
Number of motors	8	
Number of guiding trucks	2	
Number of axles per guiding truck	2	
Total length of locomotive	112	feet
Rigid wheel base	10	feet
Voltage of locomotive	3000	
Voltage per motor	1500	
H. P. rating one hour—each motor.	430	
H. P. rating continuous each hour.	375	
H. P. rating one hour—complete locomotive	3440	
H. P. rating continuous—complete locomotive	3000	
Trailing load capacity, two-per-cent grade	1250	tons
Trailing load capacity, one-per cent grade	2500	tons
Approximate speed at these loads and grades	m. p. h. 16	

The Chicago, Milwaukee & Puget Sound Railway, from Harlowton to the coast, crosses four mountain ranges; the Belt Mountains at an elevation of 5,768 feet, the Rocky Mountains at an elevation of 6,350 feet, the Bitter Root Mountains at an elevation of 4,200 feet and the Cascade Mountains at an elevation of 3,010 feet. The first electrification between Three Forks and Deer Lodge calls for locomotive operation over 20.8 miles of two-per-cent grade between Piedmont and Donald at the crest of the main Rocky Mountain Divide, so that the locomotives

will be fully tested out as to their capacity and general service performance in overcoming the natural obstacles of the first engine division.

The initial contract calls for nine freight and three passenger locomotives having the above characteristics and similar in all respects, except that the passenger locomotives will be provided with a gear ratio permitting the operation of 800-ton trailing passenger trains at approximately 60 miles per hour, and will, furthermore, be equipped with an oil-fired steam heating outfit for the trailing cars. The interchangeability of all electrical and mechanical parts of the freight and passenger electric locomotives is considered to be of very great importance from the standpoint of operation and maintenance.

The cab consists of two similar sections extending practically the full length of the locomotive. Each section is approximately 52 feet long and the cab roof is about 14 feet above the rail exclusive of the housings for ventilation. The trolley bases are about five feet above the roof owing to the unusual height of the trolley wire, which will be located at a maximum elevation of 25 feet above the rail. The outer end of each cab will contain a compartment for the engineer, while the remainder is occupied by the electric control equipment, train heater, air brake apparatus, etc.

Motors.

The eight motors for the complete locomotive will each have a normal one-hour rating of 430 horsepower with a continuous rating of 375 horsepower. The eight motors will thus give the locomotive a one-hour rating of 3,440 horsepower and a continuous rating of 3,000 horsepower, which makes it more powerful than any steam or electric locomotive ever built. The drawbar pull available for starting trains will approximate 120,000 pounds at 30 per cent coefficient of adhesion.

Each motor will be twin-geared to its driving axle in the same manner as on the Butte, Anaconda & Pacific, the Detroit River Tunnel and the Baltimore & Ohio locomotives, a pinion being mounted on each end of the armature shaft. The motor is of the commutating-pole type and has openings for forced ventilation from a motor-driven blower located in the cab.

The freight locomotives are designed to haul a 2,500-ton trailing load on all gradients up to one per cent at a speed of approximately 16 miles per hour and this same train load unbroken will be carried over the 1.66 and two-per-cent ruling grades on the west and east slopes of the Rocky Mountain Divide with the help of a second similar freight locomotive acting as pusher. Track provision is being made at Donald, the summit of the grade, to enable the pusher locomotive to run around the train and be coupled to the head end to permit electric braking on the down grade. In this case, the entire train will be under compression and held back by the two locomotives at the head end, the entire electric braking of the two locomotives being under the control of the motorman in the operating cab of the leading locomotive. It is considered that electric braking will prove very valuable in this mountain railroading; for, in addition to providing the greatest safety in operation, it also returns a considerable amount of energy to the substations and transmission system, which can be utilized by other trains demanding power. In this connection, the electric locomotives will have electric braking capacity sufficient to hold back the entire train on down grade, leaving the air-brake equipment with which they are also equipped to be used only in emergency and when stopping the train. There is, therefore, provided a duplicate braking system on down grades, which should be reflected in the greatest safety of operation afforded and the elimination of a considerable part of break-downs, wheel and track wear and overheating with consequent reduction in maintenance and improvement in track conditions.

With the completion of the remaining engine divisions, it is proposed to take advantage of the possibilities afforded by the introduction of the electric locomotive by combining the present four steam-engine divisions into two locomotive divisions of appromiately 220 miles length, changing crews, however, at the present division points. As the electric locomotive needs inspection only after a run of approximately 2,000 miles, requires no stops for taking on coal or water, or layover due to dumping ashes, cleaning boilers or petty roundhouse repairs, it is expected that the greater flexibility of the locomotive so provided will result in considerable change in the method of handling trains now limited by the restrictions of the steam engine.

The electrification of the Chicago, Milwaukee & St. Paul is under the direction of C. A. Goodnow, assistant to the president in charge of construction, and the field work is under the charge of R. Beeuwkes, electrical engineer for the railway company.

London's Postal Electric Railway.

The British Postmaster General has placed the first contracts in connection with the $5,500,000 underground railway for conveyance of mails in Central London. It will run, by electric power, from Paddington in the west to Whitechapel in the east, and will have six intermediate stations. It will convey letters, parcels and all kinds of postal packets which should be accelerated in delivery, but, more important, it will afford greater frequency in the transfer of letters and parcels between post offices on the route, producing a more economical distribution of the postal force. Congestion on the surface thoroughfares will be relieved. There will be a nine-foot tunnel containing two tracks, and the stations will consist of an island platform, in the center of which electric elevators and conveyors will be provided for quick transfer of mails between platforms and sorting offices. The trains will run at 25 miles per hour average speed; will consist of one, two or three trucks, and will have no drivers, being operated by a system of distant control from cabins situated at the stations.

Accident Prevention in Louisville.

The Louisville Gas & Electric Company, through the medium of its employees, is making "Safety First" one of its principal objects. Already, as a result of efforts of the company and the men on the Committee on Safety First, accidents during the last six weeks have shown an average reduction of 50 per cent, though the period is not long enough for this gain to be greeted as a definite accomplishment. In the year and a half that the Louisville Gas & Electric Company has been in existence accidents of all kinds, to employees, to outsiders, to equipment, had averaged 11 each fortnight, this term being selected as the basis because the employees' meetings are held every two weeks.

For the last six weeks, however, these accidents have been reduced to an average of 5.5 each fortnight, exactly half of what they had been theretofore. In order to bring the proposition right home to the men in every department the plan has been adopted of posting on the bulletin in the assembly room a report from each department showing the number of accidents since the preceding meeting.

With the approval of Donald McDonald, vice-president and general manager of the company, the Committee on Safety First, of which A. W. Lee is chairman, has just announced a safety first contest, stating that at the employees' meeting on January 2 three prizes of $5, $3 and $2 will be awarded to the persons who make the best safety suggestions. The latitude of the available suggestions is extensive and it is announced that reports of wires down, arcs out, high stop boxes, etc., will be considered in that light.

The committee, which has adopted the motto, "Safety First for Your Partner," will issue bulletins at intervals and distribute them to the superintendents of the various departments of the company to be posted for perusal by the employees. These will contain items the members of the committee may think will be of value in reducing the number of accidents.

Commercial Practice
Management, Rates, New Business

Kansas City, Mo., Keeps Up Load-Building.

The Kansas City Electric Light Company, on November 15, was 2,000 meters ahead of October 1. Houses are being wired at the rate of 200 a week, the number some days reaching 40. The company is prosecuting a vigorous advertising campaign, along the same lines as last summer. The advertisements are attractive, clever, and contain the real human-interest touch that appeals to the housewife; the touch that makes her and her husband and the children think of the comfort, safety, convenience and efficiency of electric equipment. There is one for instance of a husband, astounded upon his home-coming to discover his wife pleasantly engaged in ironing with an electric iron. The legend: "Don't get scared, Henry. It only costs $1 a month—kitchen wired for electric light, one 60-watt lamp and electric flat-iron—all for $12."

Then a particularly effective advertisement on the first day of actual winter temperature, which brought a diminution in the flow of natural gas, had a picture of "Winter," dripping icicles, and a gnome representing a light bulb projecting electric rays at him, at the same time exclaiming, "You great big frost." The legend reads: "Winter has no terrors for electric light. It never gets dim or goes out. You can have your house wired now at a very moderate cost, with 12 months to pay, and no interest."

Other recent advertisements of gas and electric companies throughout Missouri and Kansas appeal to the public from many different angles. The Fort Scott Gas & Electric Company, one of the largest advertisers outside of Kansas City, has made a variety of appeals as to convenience and comfort of electric light, rather emphasizing the feature of safety and the desirability of a house lighted by electricity. In one of its advertisements it makes the statement, "A wired house sells better, rents better and makes a more comfortable home for yourself. In building a new house today you would have it wired from cellar to garret. Why not wire the old one?"

The Kansas Gas & Electric Company, Wichita, has introduced a new friend to the readers of advertising in the presentment of a wiring man wearing a broad smile on his face, a coil of wire on his right arm and a tool kit in his left hand. The legend says: "Ask one of the new-wrinkle wiring men to wire your five room cottage," etc., continuing with further details of the wiring service offered under a special plan. A little bit of verse in connection with the picture of the wiring man cements the impression: "Make the old home bright and your light bills light."

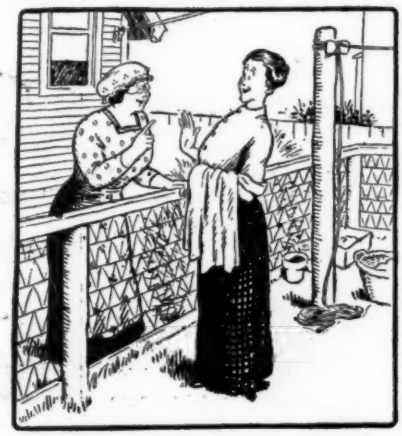
The Topeka Edison Company is making a special effort to reach the mer-

"Don't Get Scared, Henry"

"It only costs $1 a month—kitchen wired for electric light, one 60 watt lamp and an electric flat iron—all for $12. How's that for a bargain?"

You can have your kitchen or laundry wired on the same easy terms. Just call us up.

Kansas City Electric Light Company
15th Street and Grand Avenue
Telephone: Bell Grand 50 Home Main 50



Mrs. Jones was talking over the back fence to Mrs. Brown the other day. The secret is too good to keep. This is what she said:

"You may not believe it, but I only paid *one dollar down!* And now I have electric wiring in my kitchen, a two-outlet wall bracket, a 60-watt electric lamp, *and* an electric iron. The whole thing is costing me only $12, and I can take a year to pay it, if I want."

The Lighting Company will do the same thing for you if you will call them up.

Kansas City Electric Light Company
15th Street and Grand Avenue
Telephone: Bell Grand 50 Home Main 50

Newspaper Advertisements Used by Kansas City Company in a Recent Campaign That Brought Excellent Results.

chant in stimulation of window lighting, suggesting that if trade is poor there must be a cause and perhaps the poor light in the show windows is the chief cause. It suggests further that a mighty good way to bring increased holiday business is to go after it, the first step being to make the store bright, attractive and inviting, with a liberal use of electricity. "Light up your place to bring the people in and so they can see what you have to sell," is a striking phrase used.

The Electric Light Company of Arkansas City declares that an investment that pays is electric light, and adds, "Every socket in the home will pay a dividend — in increased light — if you use Mazda lamps."

A seasonable appeal by the City Light & Traction Company of Sedalia, Mo., is a picture of a man and a woman at wash basins where the water steams and the suggestion to buy hot-water heaters for this cold weather.

The electric light companies and the municipal plants generally have urged that this be an electrical Christmas; and also they almost universally pressed the "shop early" movement.

Bridgeport Celebrates Opening of White Way.

On December 17 the city of Bridgeport, Conn., celebrated the opening of its new White Way. Over 25,000 people congregated on the streets in the center of the city, and there were fully 2,000 men in line representing all creeds and all political parties. The system includes ninety-two 4.4-ampere Magnetite arc lamps set on ornamental standards. The lamps and lamp standards were supplied by the General Electric Company. Okonite cables were installed for the underground system, under the direction of Lewis G. Martin, chief electrical engineer of the Okonite Company, New York.

Attractive Electric Kitchen and Show-Room Signs.

The enviable prominence which the St. Marylebone Electric Supply Department, London, England, has achieved in the building up of a great cooking and heating load, is in large part accounted for by the interesting and persistent advertising campaign which the station has prosecuted. The offices and show rooms of the Department are unpretentious, being located in what was evidently once a private dwelling of ample proportions, on Baker Street, W. The use of electric signs of a distinctive nature, however, calls direct and forcible attention to the place and its uses.

A rectangular metal transparency with letters of ground glass is attached to the building front near the entrance, by an ornamental iron framework, and in connection is a circular transparency outlining an index hand which points to the door of the show room. Electric lamps within illuminate the signs after dark.

The Department's electric kitchen is at the front of the building, large windows giving a view of the operations going on inside. Flowers on the window sills give a homelike touch, and the uses of the place are pointed out by means of a "Diaphanad" illuminated sign about 14 inches by 20 inches, and pendent on chains. The sign consists of a thick glass pane set in brass frame, and the illumination is by means of tubolites, installed in the hoods below and above the pane,

Central-Station Sign Used in England.

which shine up and down on, and illuminate, the ground glass letters. The sign is operated constantly or with a flasher, at will. Signs similar to the former are also used extensively throughout the city, calling attention to central-station service. They are usually attached to trolley poles.

Electric Laundry for Minneapolis.

George J. Gautier, of Gautier, Allan & Jones, consulting engineers, Minneapolis, has been chosen to take charge of the electrical work in the new steam laundry which is being equipped by the Waldon Steam Laundry Company, Minneapolis. This firm recently purchased the plant of the old Minneapolis Needle Company and is to install electric equipment of the most modern type. While there are other laundries in the west that will have larger capacity, it is the aim of the firm to have its plant take first rank among laundries utilizing the latest improved electrical machinery to increase efficiency.

WHERE THE MONEY GOES.

By R. O. Wye.

During these days of curtailment and retrenchment we are called upon daily to consider more and more seriously the necessity for expenditures that, a year ago, would be classified as miscellaneous incidentals and forgotten.

Very many business men of this country, particularly those who are managers—or superintendents of corporation departments, have become so adept at discovering nickel leaks that they do not recognize a dollar loss when they see it. It is a case of getting a nickel so close to the eye that a bushel of dollars at arm's length is invisible.

There may be two fundamental causes for immense leaks in every organization. The direct results of these may be found in 90 per cent of our corporation organizations. These are unproductive labor or misdirected efforts and organization inefficiencies.

The first cause may be divided into five common errors. First, time wasted. The greatest waste of time is *not* when the employee slips out the back door to smoke a cigarette, nor is it when he comes to work a half hour late in the morning. It is *all the time he has, is and will be* employed in the wrong job. Time was wasted when he was employed, and the last minute to be lost will be when he is paid off. This does not mean that the employee alone is to blame—perhaps he was unfit for the work placed before him. At the best he is but half to blame. When men fail to get development, pleasure and living out of their work, they and their employers are wasting time.

The second error is the supervision of unproductive labor, the vain effort to teach men the technical before they have learned the elementary.

The third error, most prevalent of all, is destructive supervision. The supervisor with inadequate knowledge of economic principles; the extremely poor co-ordination of workmen; the issuance of inadequate or counter instructions; the making of arbitrary rules without reasonable cause; poor moral and business examples made by superiors to their subordinates; placing progressive men in dead-end positions where they may work themselves to death on a treadmill, all contribute to this decrement. That oil is necessary for a machine is generally believed. That education is unnecessary for the forces that control the machine is nearly as generally admitted. Lubricate the engine, educate the organization, and make the dividends for cor-

poration and employee greater and the cost of the finished product less.

The fourth common error is the education of incompetents. Every moment spent in the development of a man should be governed by the same foresight as the cash invested in the development of a commercial product, an advertisement, or a machine. When the product is complete will it have commercial value? This is the first question asked when the development of any article is proposed. However, when employing a man the question is changed to "Will he work for two dollars a day?" The first able-bodied man to apply for a job is accepted regardless of his latent ability, his natural qualifications for the job, or the slightest consideration of what his development in the organization will be.

Probably the least error of all, though most emphasized, is material and supply losses. These may be practically eliminated by the education of those who use it. Teach them the value of material and its proper use. The result will be surprising. The least suspected subordinate will make suggestions that are indeed valuable. First, however, his mind must be fertilized with a few thought-producing facts.

The second fundamental cause of these vast leaks is the inefficiency of organizations. It is not the object to set forth any plan of organization as a panacea for this fault. All classes of organizations may be nearly perfect, and likewise grossly imperfect. It is in the administration that the greatest errors are usually found. The first is as old as man, and is very difficult to overcome, if even possible. It is business based on friendship. The second is politics, public and private. The latter is a by-product of corporations. Both are economic losses. Neither are profitable to the friend, the politician, or the consumer. Nature has wisely designed the universe in accordance with a few laws which from a physical viewpoint are considered sound and without flaws. However, when applied to man or a legal person in the form of a corporation their meaning seems to be lost. Science teaches us that for every action there is an equal and contrary reaction, that neither matter nor energy can be destroyed, and, in the animal and vegetable world, that the fittest will survive.

Fig. 1.—Christmas Tree in Brooklyn Display Room.

Why try to deceive ourselves that we are made fittest by holding a political employee who is a burden to our overhead, particularly so when his expense account would more than correct the details he is employed to shield? Why will a man be permitted to build up an absolute monarchy within an organization to grow and wax fat, a parasite on a public utility providing property?

Brooklyn Edison Christmas Campaign.

From all parts of the country have come reports of energetic campaigns to further popularize the practice of giving electrical appliances as Christmas gifts and it is safe to predict that all previous records have been broken by appliance sales this year. Department stores, hardware stores, and others joined with the electrical dealers and central stations in featuring electrical gifts.

In Brooklyn, N. Y., no effort was spared by the Edison Electric Illuminating Company in attractively displaying the hundreds of electrical devices suitable for gifts.

Fig. 2 shows the electrical giftware window display of the company with the artistic arrangement of electric appliances. The reindeer centerpiece was equipped with flashing eyes and attracted considerable attention. Fig. 3 shows the interior of the display room in holiday attire. The central feature was a mammoth Christmas tree, tastily decorated and equipped with electric tree lamps. A detail view of the tree is shown in Fig. 1. Palms, holly wreaths and other Christmas decorations were freely used throughout.

Attendance at this exhibition was greatly stimulated by sending to all customers of the company an attractive Christmas card reading, "The Edison Electric Illuminating Company of Brooklyn invites you to an exhibition of electrical giftware at the Edison Shop, from December 7 to December 24.

"This display will embrace the latest conceptions in goods electrical including many new, attractive and inexpensive electrical gifts.

"Of especial interest will be the electrically lighted Christmas tree. In fact, the Edison shop, with its Christmas decorations is fitly characterized as 'the most beautiful showroom in Brooklyn.' Music. Refreshments, electrically cooked."

Fig. 2.—Display of Devices in Show Window.

Fig. 3.—Interior of Brooklyn Show Room.

Electric Vehicle Data

United States Government Uses Many Electrics.

The number of electric trucks in the United States government service is continually increasing, and the rapid expansion of the parcels post field would indicate that hundreds more will soon be added for that end of the postal service. Sixteen electrics are so used in New York city, and 20 more of two-ton capacity have recently been placed in regular mail-delivery work.

Eight navy yards, three arsenals, the government office in Washington, one naval hospital and two army depots use electrics in this country, and in Manila more than 40 are used by the war department and the various branches of the Philippine government.

The bureau of supply of the Philippine government formerly hired horses and mules from the department of sanitation and transportation of the city of Manila, but in 1909 a one-ton electric was installed in the division cold storage, which furnishes ice, distilled water and refrigeration to the general public, as well as the various government offices and the army and navy of the United States.

The satisfaction given by this one truck was so great that between September, 1909, and September, 1912, 24 more electrics of the same make, running from one ton to five tons, were installed.

Of the 65 electrics placed in government service by one manufacturer, 33 are in Manila, 12 in New York, two in Boston, two in Philadelphia, one in Frankford, five in Washington, two in Charleston, two in Brooklyn, one in Portsmouth and one in Puget Sound. The library of congress and the bureau of standards have two each.

On account of its reliability and economy of operation, the electric truck has earned the recognition of the government officials, and it is reported that one Washington department which replaced several gasoline and horse-drawn wagons with electric trucks about two years ago has thereby averaged savings amounting to $1,000 annually on each of the battery-driven cars installed.

It was brought out at the recent convention of the Electirc Vehicle Association of America, at Philadelphia, that in 50 of the principal cities of this country, having an aggregate population of over 25,000,000 inhabitants, nearly 11,000,000 parcels were mailed out from these 50 post offices during the interval from October 1 to October 15, 1913, while 3,500,000 parcels were received for local delivery during the same period. The average weight per parcel was one pound 11 ounces, and the average postage paid per parcel was 10 cents. Almost three-quarters of the total number of parcels handled were delivered by regular carriers without additional expense, while about 350,000 parcels (approximately 10 per cent) were handled by automobiles of one kind or ancther, at a total cost of $17,653, or about five cents per parcel. In the 50 cities for which figures were obtained one inhabitant in every seven received a package through the parcel post service during the two-week period named.

In striving to secure parcel-post business, the Electric Vehicle Association of America is calling the attention of government officials to the demonstrated qualifications of the electric vehicle.

A comprehensive campaign has been outlined and the cooperation of various organizations enlisted. Authentic data are being compiled to use in this connection.

GENERAL

Name of Company—Eagle Furniture Company, Memphis, Tenn.	
Business—Furniture (retail).	Make of Tires—U. S.
Capacity of Vehicle—2,000 lbs.	Size of Tires—3½x33 inches.
Date of Purchase—Feb., 1912.	Tires—Solid.
Approximate Price—$2,800.	Make of Battery—Edison.
Make of Vehicle—Detroit.	Type of Cells—6-A.

OPERATING DATA.

Average Daily Mileage—30-40.	Cost of Storage and Washing, per Month—$20.
Daily Hours in Use—10.	Driver's Salary, per Month—$40.
Days in Service, per Month—26.	Cost of Repairs and Renewals for 23 Months—Battery, $35; Other, $250.
Cost of Electric Power, per Month—$35 (average).	

Total Average Monthly Operating Cost—$110.

Electrical Construction

RUNNING CONDUCTORS TO SIDE OUTLETS IN FINISHED-BUILDING WIRING.

By Terrell Croft.

Running wires to switch and fixture outlets in partitions is probably the most difficult work encountered in the wiring of finished buildings. A considerable percentage of the total wiring lies within partitions, and great ingenuity must often be displayed in running the conductors to specified outlets without damaging the walls. Where there is no bracing or other obstruction within a partition and the header can be reached from an attic or by removing floor boards, the operation is simple. A hole is bored in the header, a "mouse" (Fig. 1) is

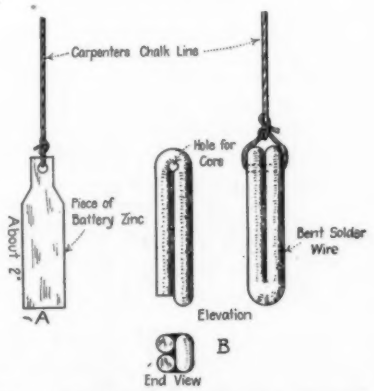


Fig. 1.—Details of Mouse Construction.

dropped through and the wires are pulled up, by attaching them to the mouse string, from the outlet hole in the partition to the hole in the header. All wires within partitions and in other places where they cannot be supported on porcelain must be sheathed in circular loom, which is slipped over the wires before they are pulled in.

There are several methods of getting conductors past obstructions to wall and partition outlets. In a great many cases, the bringing out of the switch loops at outlets at a proper distance from the floor is the most exacting feature of wiring old houses, on account of the cross pieces or bridges sometimes found in partitions. The method to be used must be determined by the wireman on the job, according to the conditions found. The procedure is as follows.

First, with his mouse, he finds if the runway is clear; if so, the rest is easy. But, if he finds there are cross-pieces, he locates their position by measurement with the mouse, and marks the location

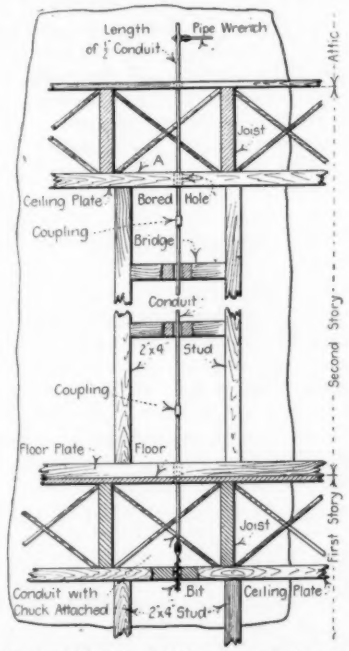


Fig. 2.—Method of Using Pipe-Extension Boring Tool.

on the wall. If the cross-pieces are above the proper position for the switch, he will probably use one of the following methods (which are described in detail later) of getting around them:

(*a*) Remove the door stop strip from the frame of the doorway, bore through

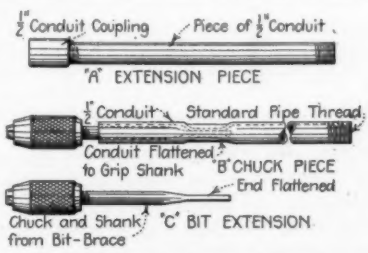


Fig. 3.—Chuck End of Pipe-Extension Boring Tool and Detail of Bit Extension.

on each side of the cross-piece, and cut a recess in the inside of the frame; then fish the wires around.

(*b*) If on the second floor, and there is no partition directly above, the wireman can use a pipe-extension boring tool (Figs. 2 and 3), boring one hole large enough to fish the switch loop through.

(*c*) If the cross-piece is not too far above the proposed location of the switch, the holes can be drilled on a slant from the switch opening. (See Fig. 4.)

(*d*) Remove the wallpaper directly over the cross-piece. Then cut a hole and bore holes or cut away the cross-piece so that the wires will pass.

(*e*) Sometimes a wireman will at-

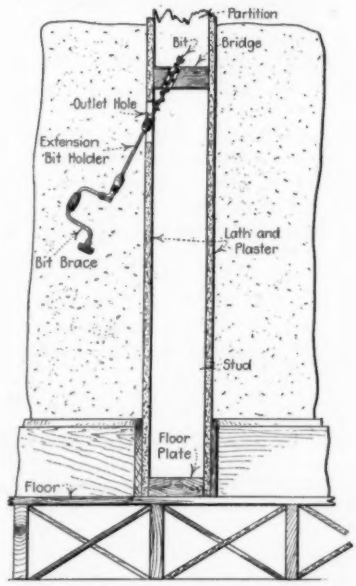


Fig. 4.—Method of Boring Hole Through Bridge from Outlet Opening.

tempt to remove these cross-pieces when he can get at them from above, by putting a piece of pipe down between the partition, and hitting with a heavy hammer. This method is liable to cause damage to the plaster by bulging or breaking out, and is not recommended.

(*f*) When a switch must be located on a brick wall, it is necessary to run wires in rigid or flexible steel conduit. The wall must be channeled, and the conductor buried in it, and the groove re-plastered. At the point where the metal terminates under the floor, a suitable outlet fitting must be provided.

When a partition outlet is near a doorway, the vertical conductors can be run past bridges within a partition by removing the door jamb and following the method illustrated in Fig. 5. In the case shown it was not feasible to bore down

from above with the long-distance boring tool, so the conductors were carried up from below. The door jamb in such a case can either be pried loose and bent up, as shown at *A*, Fig. 5, or a saw cut

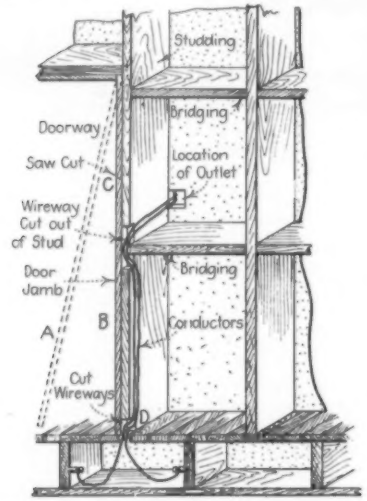


Fig. 5.—Carrying Wires Around a Bridge.

can be made in the jamb as at *C*, and the section *B* of the jamb can be removed. In either case, the stud at the side of the door is exposed and a wireway can be cut in its outer surface around bridges or other obstructions as shown. At the floor a hole can be cut through the stud, as shown at *D*, and through this hole another can be bored through the floor. The conductors are then carried through this floor hole into the space between the joists. The building code of most municipalities requires that all conductors within partitions and not supported on porcelain be carried in circular loom. Allowance must be made for this in boring holes and cutting wireways.

To carry conductors past a bridge in a wall when a doorway is not adjacent and when the long-distance boring tool is not applicable, it is necessary to cut into the surface of the wall as shown at Fig. 6, and as described in the following paragraph. Through the bared plaster cut holes into the partition above and below the bridge, and remove enough plaster from in front of the bridge to leave a cavity that will accommodate the loom-covered conductors. The conductors may then be run in as suggested in the longitudinal section *C*. The hole left in the wall surface should be filled with plaster of Paris and the paper carefully replaced as described in the following paragraph.

A method of cutting wallpaper to expose plaster for making a fishing hole without disfiguring the wall decoration is illustrated by *A* and *B* of Fig. 6. With certain kinds of wallpaper the method here described can be used with practically no visible damage. If the wallpaper is such that moisture will disfigure it, this method should not be used. Cartridge papers are not, as a rule, affected by a little water. In order to ascertain the effect of water on the paper in question, it will be necessary to experiment with a small area in an inconspicuous corner.

If the paper stands the test, two slits can be cut through it at right angles to each other, as shown at *A* of the illustration, at a point just opposite the bridge. The bridge can be located by dropping a mouse on it from the outlet hole cut through the partition at a point above it. A very sharp knife should be used in cutting the slits.

Ordinarily the paper should be soaked slightly around the slits with a wet sponge or cloth. When the water has been absorbed by the paper, and the paste that held it to the wall has softened, peel back the four triangular sections of paper. A wide-bladed putty knife is a convenient tool for the purpose. Be careful not to crack or crease the paper. In old buildings where there are many thicknesses of paper on the wall, they can, frequently, be removed without moistening. When the paper is completely peeled it will appear as shown at *B*.

Should there happen to be a figure or a flower in the wallpaper design directly

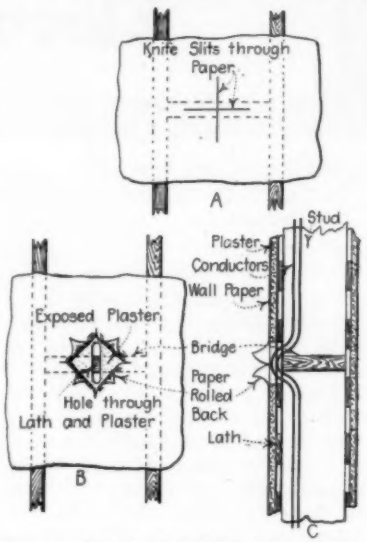


Fig. 6.—Method of Cutting Into Plaster.

over the bridge within the wall, the double slit is not made, but instead, the entire design is cut out of the wallpaper with a sharp knife.

A hole is now made through the laths and plaster to accommodate the conductors and they are drawn in. After they are in, the hole is filled with plaster of Paris and the design can be replaced on the wall so neatly that the casual observer will not know that the paper was cut. The hole in the plaster should always be somewhat smaller than the piece of paper removed from the wall.

A 2-by-4-inch sill is sometimes placed under the lower ends of studs that form a partition, as shown in Fig. 7. Where this construction is encountered and it is not possible to bore through the sill from above with the pipe-extension boring tool, the baseboard must be removed as shown. After the baseboard is off, an

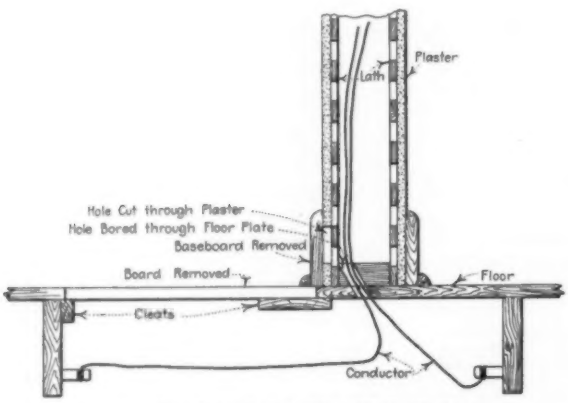


Fig. 7.—Method of Cutting Through Sill.

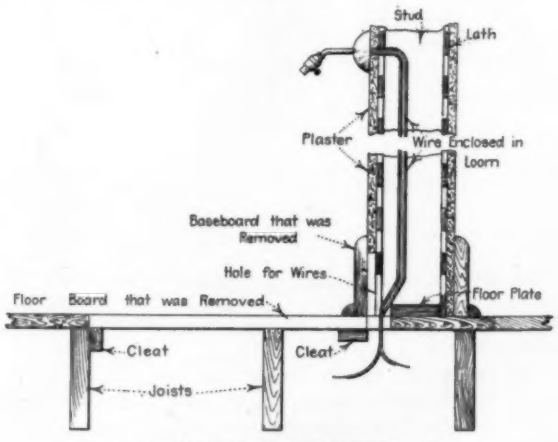


Fig. 8.—Method of Wiring Around a Sill.

orifice is cut through the lath and plaster and a slanting hole is bored through the sill and the floor. Sometimes it is not necessary to bore the hole, as the wires can be run in a space formed by removing some lath and plaster, as suggested in Fig. 8. Where large conductors are involved it is usually necessary to bore through the sill.

Often the condition illustrated in Fig. 9 is encountered. It is necessary to draw conductors from an outlet in a partition in one story to an outlet in a partition in another story. Where the partition of the story above lines up with that of the story below, the conductors can usually be drawn in by cutting a pocket close to the foot of the partition in the second story. Where, as in Fig. 9, the partitions do not line up, it is more difficult to get the conductors in without disfiguring the building. Frequently the partition in the lower story lies under a hall or other second-story room that has a nicely finished bare floor from which the wireman does not dare to remove boards.

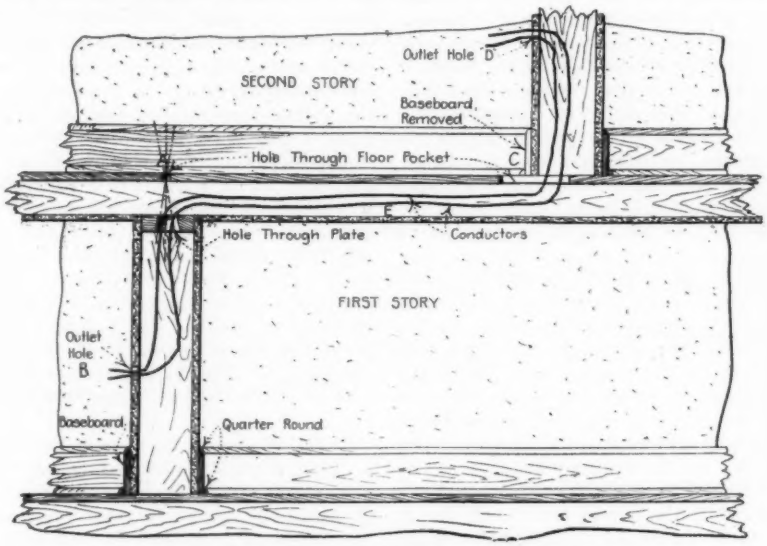


Fig. 9.—Fishing Between Partitions on Different Floors.

One solution of the problem is to bore one five-eighths or three-fourths-inch hole directly over the plate of the first-story partition as indicated at *A*. Then through this hole, by pitching the bit and using one having a long shank or an extension bit, a half-dozen holes can be bored through the plate—all through the one center hole in the floor. Instead of making several small holes in the plate it is possible to make one large one by boring the small holes around in a circle and then knocking out the block with a bar or a piece of conduit. To draw in the conductors: A mouse or a fish chain is dropped in at *A*, and pulled out at *B*. Then a snake is pushed in at *C*, through *E*, and drawn out with a hooked probe (see Fig. 10) at *A*. The snake and fish wire are fastened together at *A* and the chain is drawn by the snake over to *C*. Now the conductors are fastened to the lower end of the fish chain which is extending from *B* and the conductors are pulled in over to *C*. From *C* the conductors are readily drawn up to *D*.

A plug of suitable wood, cut across the grain, and tapering so that it will fit nicely, is made for the hole *A* and driven therein. Its top can be planed off flush with the surface of the floor and if its grain was selected to match that of the floor it will be difficult to locate.

A receptacle for an extension plug mounted in a baseboard is a good substitute for a wall fixture when it is objectionable to channel the brick wall to the regulation bracket height of 4 feet 6 inches. The method is illustrated in Fig. 11. By means of an extension cord a portable or table lamp can be substituted for the wall fixture. It will be noted from the figure that it is not necessary even to remove the baseboard. A slanting hole is drilled from the pocket for the baseboard receptacle to another pocket cut beneath the floor. A short piece of conduit is then installed from the receptacle outlet to the pocket under the floor. Such a baseboard receptacle also forms a convenient means of attachment for portable vacuum cleaners and various heating devices.

Heating of Screw Sockets.

Results of a series of experiments made on the heating of screw sockets have been communicated to the *Journal of the Institution of Electrical Engineers* in the form of an original communication, by C. C. Paterson, of the National Physical Laboratory. The object of the tests was to investigate the temperature rise in such sockets of different types when used (*a*) with radiators, (*b*) with lighting fittings.

The conclusions reached are (*a*) that as far as temperature rise is concerned, ordinary screw sockets may be used for radiator lamps up to at least 500 watts each (the maximum size of heater lamps at present on the market); (*b*) the screw socket is also satisfactory as at present used, for lamps rated up to at least 1,000 watts but in the present designs the clamping contacts for the incoming leads become too hot to allow rubber-insulated cables to be brought into the sockets without risk of serious deterioration of the rubber.

Among the Contractors.

An important contract has been closed by the Avery-Loeb Electric Company, of Columbus, O., for wiring the Donavan Hotel, Delaware, O. A banking room is included in this modern structure.

One of the largest and most progressive electrical firms in eastern Pennsylvania is the Lehigh Electric Company, of Allentown, Pa., of which A. S. Weibel is the proprietor. Conveniently situated in the center of the business district, this concern carries on a large trade in retail and wholesale electrical appliances and supplies. Besides contracts of all sizes are continually being fulfilled by the construction department. Among the larger orders now in hand are the following:

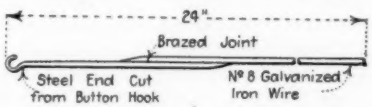


Fig. 10.—Steel-Hook Fishing Tool.

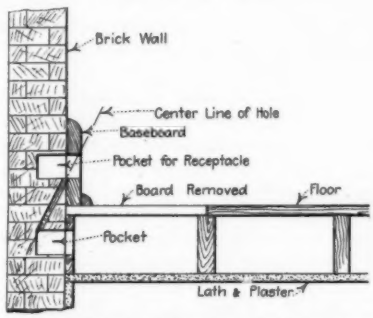


Fig. 11.—Detail of Pockets in Brick Wall for Receptacle.

The complete electrical installation and wiring for the Post & Sheldon Silk Mill at Allentown, consisting of 105 horsepower motors.

A modern conduit and underground cable installation in the magnificent new home of C. A. Buck, general superintendent of the Bethlehem Steel Company, in West Bethlehem, Pa.

The electrical installation in the new $100,000 Nurses' Home of the Allentown Hospital, construction of which has just been started.

Public Service Commissions

Conducted by William J. Norton

NEW JERSEY.

The Public Service Gas Company Case. The cities of Passaic and Paterson and also the Board of Public Utility Commissioners have taken steps to secure a re-hearing in the Court of Errors and Appeals of the decision setting aside the order of the Board in the 90-cent-gas rate case. (The decision of the court was given in last week's issue of ELECTRICAL REVIEW AND WESTERN ELECTRICIAN, page 1180). Counsel for the Board held that the effect of the decision would be to nullify the whole public-utility legislative program and that such a momentous decision should not be made by a divided court. Representatives for the cities stated that should the court refuse the rehearing, a measure will be introduced at the next session of the Legislature seeking 80-cent gas, such as now exists in New York.

The law provides that applications for rehearings must be made within ten days of the filing of the decision and the decision in this case was filed at the end of the session. The Chancellor consented to convene the court for a new session so that the petition for rehearing could be duly considered.

NEW YORK—Second District.

The Mechanicville Electric Light & Gas Company was granted authority to exercise a franchise from the town of Schaghticoke, Rensselaer County, under a contract with the town for lighting a certain street and bridge. The Half Moon Light, Heat & Power Company was already furnishing current to private consumers in the town and objected to the granting of this street lighting contract to the Mechanicville company on the grounds that it should be protected from competition, under the terms of the Public Service Commissions Law, but in an opinion by Commissioner Emmet the Commission finds that the intent of this part of the law was towards actual and dangerous competition and not the theoretical or harmless competition found in the present case.

Commissioner Emmet in his opinion finds that the Half Moon company is the larger, stronger and more profitable concern, and that, on the contract for street lighting in question, its bid was $12 per lamp as against $9.90 bid and accepted by the Mechanicville company. The Half Moon company covers a far larger territory than the Mechanicville company, and Mr. Emmet finds that it would hardly be conceivable that this business could be seriously injured by the entrance into so small a portion of its field as the exercise of a single street lighting contract. In his opinion Mr. Emmet says:

"The provisions of the Public Service Commissions Law which give an existing company protection against ruinous competition from another concern seeking entrance into its territory relate to actual, rather than to theoretical, dangers of this sort. It is obvious that there would be no real danger to the solvency of the Half Moon company. . . . And the framers of the Public Service Commissions Law never intended, we believe, to so far kill off competition between electric light companies as to contemplate the intervention of the Commission in a case like the present—where the people of a locality have indicated a decided preference for a weak concern against a strong, and where this local preference, however mistaken it may be, can be exercised without any real injury to the larger of the two companies."

The Half Moon Company also objected to the approval of the Mechanicville company's franchise and contract on the grounds that its service elsewhere was bad, and that it could not, without ruinous consequences to itself furnish the service contracted for in this instance at the price in the contract.

This, Mr. Emmet finds, is purely a matter for the local authorities, and not for the Commission, even if all the contentions of the Half Moon company are true. He finds that the town authorities show no disposition to turn the contract over to the Half Moon company, even at the same price as that bid by the Mechanicville concern, and that the good or bad judgment of the town in asking the contract is not for the Commission to pass upon at this time.

While permitting the extension of the Mechanicville company into the Half Moon company's territory in this instance, Commissioner Emmet points out that, should the former company desire again to extend to the possible injury of the Half Moon company—the Half Moon company would then have due means of redress before the Commission.

PENNSYLVANIA.

The Borough of Gettysburg filed a petition with the Commission for authority to construct an electric light plant to furnish municipal service. The Commission held that a municipality has the right under the Pennsylvania law to construct and operate its own electric light plant for furnishing electricity to light its streets and public places, and not for sale to others, without obtaining consent of the Commission. The decision says that the borough, as well as every other customer of the Gettysburg Light Company, has the right, in the absence of a contract, to discontinue the service furnished by the light company and to light its streets by means of candles, oil or acetylene. No power exists in the Commission to compel the borough to take the service furnished by the light company nor can it determine where the borough shall buy the candles or oil, or how to obtain the gas it may desire to use for lighting its streets.

The Commission sees no distinction between a municipality generating its own electricity for lighting its streets and making candles or acetylene gas for the same purpose. The Commission finds that the courts have recognized a clear distinction between the rights under which a municipality furnishes electricity for its own use and where in addition it furnishes it to the public. In the first instance it is exercising a governmental function and in the latter is engaged in a business. It is pointed out that the purpose of one of the provisions in the Public Service Company law was to prevent a municipality, without first securing the approval of the Commission, from engaging in a business which would compete with the public service company furnishing like service in the municipality and not to interfere with a truly governmental function of the municipality.

To hold a contrary opinion would mean that no municipality, without first securing the approval of the Commission, could install its own stoves or heat plant in its municipal buildings if a corporation were at the time furnishing heat for the citizens and to the public buildings in a municipality. This was not the intention of the Legislature.

Questions and Answers.

All readers of the Electrical Review and Western Electrician are invited to submit questions and answers to this department. Full names will not be printed except where the writer indicates his willingness therefor. Anonymous communications will not be considered. Questions relating to electrical matters of any kind will be inserted. Answers from our readers should be received in this office preferably within ten days of the date of publication of the question, and will be published in a subsequent issue. Payment will be made for all answers published.

Questions.

No. 240.—Life of Gas-Filled Tungsten Lamps.—What is the longest life record as yet attained on test or in service with the new nitrogen-filled tungsten lamps?—P. C. U., Springfield, O.

No. 257.—Heating of Generator Bearings.—I have heard of considerable trouble in the case of large alternating-current generators due to heating of bearings, which is supposed to be caused by an electromotive force generated in the shaft of the machine setting up a current circulating through the bearings and baseplate. Is this the true explanation? How is this trouble overcome?—P. N. L., Norwood, O.

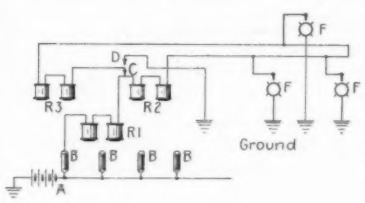
No. 258.—Smashing Point of Storage Battery.—Is there a definite and well established point in the life of a storage battery at which it becomes economical to scrap the old, depreciated plates and purchase a new element, that is, a point corresponding to the smashing point of incandescent lamps?—B. E., Newark, N. J.

No. 259—Relative Cost of Manual and Automatic Telephony.—What is the relative first cost of manual, central-energy exchange and substation equipment for, say, 10,000 telephone lines and of full-automatic equipment for the same number of lines? What is the relative operating and maintenance cost of the two systems? Does the reduction in operating cost of automatic equipment offset the increase in fixed charges?—H. L. F., Buffalo, N. Y.

Answers.

No. 249.—Automatic Open-Circuit Tester.—In some fire-alarm systems of the open-circuit type I am told that some device is provided for automatically testing the lines from time to time to see that they are in working condition. How is this done? Has it been used to check the condition of telephone lines?—D. K. Y., Ogden, Utah.

I have seen the following system used with good results in signal work. Energy is taken from a storage battery *A*, one side of which is grounded, the other side supplying fuses *B* which connect the various circuits. *R*1, *R*2, *R*3 are telegraph relays, from the local contacts of which the instruments for recording signals are connected. These instruments are not shown in sketch. *C* and *D* are contacts operated every 15 minutes by clockwork. *F* is a signal box, one side of which is connected to the line and the other side grounded. When these signal boxes are operated, the relays *R*1, *R*2, and *R*3 are energized and a signal recorded. The clockwork before mentioned opens contact *C* and closes contact *D* every 15 minutes. This records a test that the circuit is all right, if the line is closed and instruments in proper condition. If the line is open no test is received and a man is sent to locate trouble. It will be seen that on this system one break will not cut off any of the boxes. I have never heard of any method being used to check periodically the condition of telephone lines.—P. A. B., Everett, Mass.



No. 249.—Open-Circuit Tester.

No. 251.—Life of Flashing Sign Lamps.—In the case of a flashing sign equipped with tungsten lamps, is the life of these lamps shortened due to the continual flashing?—H. D. V., Lafayette, Ind.

In the 1910 "Transactions of the American Institute of Electrical Engineers" is a discussion of some experiments, conducted by Messrs. Merrill, Cooper, and Blake of the Engineering Department of the National Electric Lamp Association, to determine the effect of flashing on the life of tungsten lamps. Three lots of tungsten lamps, six lamps in each lot, were placed on test. The first lot was burned continuously; the second lot was flashed three times per minute; the third lot was flashed 30 times per minute. This test showed a slight decrease in life of the lamps flashed over those burned continuously. The authors of the paper state that the life of tungsten lamps decreases as the frequency of flashing increases until a maximum loss of six per cent of the normal total life is reached at 35 flashes per minute. As the rate of flashing is increased beyond this point the life of the lamps rises toward normal. Flashing at very high frequencies would correspond to operation on alternating current and would give the same result as continuous burning.

The explanation of this behavior of the tungsten lamp is found in the resistance and cooling characteristics of the tungsten filament. The resistance of tungsten at ordinary room temperature is only about nine per cent of its resistance at a temperature corresponding to 1.25 watts per candlepower. Because of this relatively low cold resistance there is a rush of current when the circuit is closed through the lamp and it is this overshooting to which the decrease of lamp life due to flashing is ascribed. Cooling curves for tungsten lamps show that the resistance of the filament drops with great rapidity immediately after the current is cut off, falling to about one-fifth of its hot value during the first five or ten seconds in the case of the ordinary sizes of lamps. As would be expected, the smaller lamps cool most rapidly. It takes the small low-voltage sign lamp a little over six seconds to drop to 200 per cent of its cold resistance; the 25-watt lamp makes the same drop in 11 seconds, while it takes the 60-watt lamp 20 seconds to reach a corresponding value of resistance. If the time between flashes is short, the filament cannot cool so much as when the period between flashes is longer. The resistance remains higher and therefore the current rushes are smaller when the rate of flashing is high so that the time between flashes is short. The tests mentioned above indicate that the life of tungsten lamps is probably shortened by flashing, but the effect is so small that it is of small importance, especially if care is taken to have the interval between flashes as small as practicable.—F. E. V., Madison, Wis.

No. 254.—Ground Problem.—A certain transformer supplying a dwelling and residential district, the load consisting chiefly of lamps for indoor illumination, is supplied from a 2,200-volt circuit carried on top of the cross-arm of each pole; the secondary wires are strung on separate cross-arms, placed four feet below and run parallel to the primaries. The secondary system is three-wire, 220-110 volts, with neutral permanently grounded at some point near the transformer. At the moment of an accident of the nature shown by the accompanying diagram, the case where the primary wire marked *Pa* would become detached, or broken, and fall across the secondary marked *Sa*, would the high-tension current rush to ground through that half of the secondary coil, by overcoming its reactance, or would it tend to follow the path of low resistance, approximately 4 ohms (resistance of the load at time of contact) to ground through the neutral?—J. H. M., Quebec, Canada.

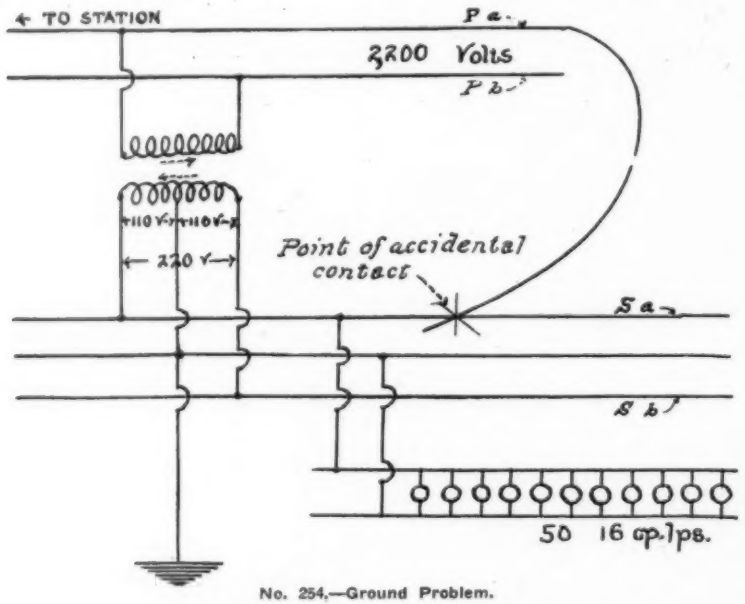
If your system has as much as a thousand feet of overhead primary, and you make a test to ground, between either line wire and the earth, you will find a voltage which should be equal, providing you use an instrument with an appreciable current flow and not an electrostatic voltmeter or ground detector; this condition exists because the primary is likened to one side of a charged condenser, and the secondary and the earth become the opposite side of the condenser; the total leakage of the system through the insulation of transformers, over the outside of the insulators and through grounds and crosses, caused by branches

of trees, etc., all go to determine what the values are to be when making the tests I propose. Now, suppose we ground one line wire at the point mentioned in the question involved, will we get current flow? If so, how much? And what are the factors which influence the result, also what are the dangers?

Most assuredly, we get current flow, the same as if we discharge any condenser. The amount will depend largely upon the size of the system; number of miles of wire overhead and underground; ability of the insulation on the ungrounded conductors to withstand the voltage rise, which it is seen occurs at once, due to the accidental grounding of the first conductor; the kind of earth connection, its proximity to underground structures of gas or water pipes, and railroad tracks of steam or electric railways.

If the earth connection is made to a buried ground of limited dimensions, having a resistance of from 5 to 100 ohms (with one ampere flowing), then the total voltage from secondary to earth will depend on the distance between the point at which the secondary is grounded and the point of contact. This is due to an electric unbalance of potential or potential gradient, which exists in the ground itself in the vicinity of the ground pipe or plate. On long secondaries, this may reach a value of from eight to ten times normal secondary voltage, and hence introduces an additional complication, which demands consideration, either in the shape of more frequent grounding, or the use of some system which will make it possible to locate a leak in the primary insulation, as soon as it reaches a value where there exists a hazard to life or property. The transformer will probably not clear itself from the line, even though its insulation has broken down entirely. We should not feel that grounding secondaries prevents damage or hazard in the case of cross between high and low-potential lines, but rather that it minimizes the danger and makes it possible to detect the condition, when it does occur, thereby giving us sufficient notice to remove the cause of the trouble, instead of having our first notice of danger only after some one is hurt or some damage has been done.

The division of current between load and transformer will depend partly on the value of the load resistance, as well as the design of the transformer, as the half secondary winding is subject to demagnetizing influence, due to the primary current flow being approximately 180 degrees away from the normal secondary current.—C. K. C., Chicago, Ill.



No. 254.—Ground Problem.

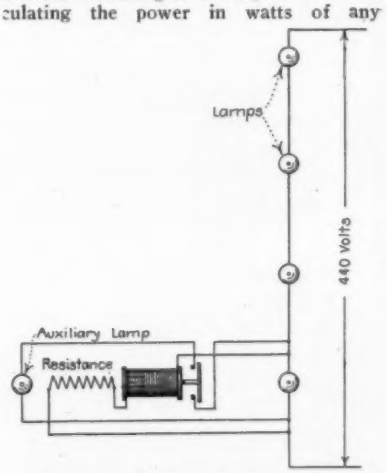
No. 255.—Automatic Cutout for Series-Multiple Lamps.—Is there any way of arranging one or more switches and fuses on a 440-volt circuit so that when there are four 110-volt lamps connected in series one may burn out without affecting the other lamps? Are there any devices on the market and approved by the Underwriters for preventing all the lamps on such a circuit from going out when one burns out, or is there any way of overcoming this difficulty? If there is any way, please show the arrangement by a diagram.—V. J. L. N., New York, N. Y.

Rule 22*c* of the National Electrical Code says: "No electromagnetic device for switches and no multiple-series or series-multiple system of lighting will be approved."

Without making use of any electromagnetic switch or switches it would not be possible to accomplish the desired result on direct-current circuits. Even were these allowed it would be cheaper to install a small transformer, if alternating current is used, to permit connecting the four lamps in parallel to its secondary.

However, if these are signal lights on direct current, the following method could be used.

Across each of the lamps would be wired the solenoid of an electromagnetic switch (the diagram shows only one lamp so equipped) and also a second lamp of the same voltage and candlepower as the others. The switch would be cut into the lamp circuit and sufficient resistance installed in the solenoid circuit so that under normal conditions of operation not sufficient current would flow to operate the switch. A switch of this kind requires about one-quarter of an ampere to operate it. If a lamp burns out, the solenoid of that lamp is in series with the other three lamps across 440 volts. Assuming the resistances to have been properly adjusted, this will allow a little over one-quarter ampere to flow and the switch to operate, causing the emergency lamp to be cut in service.—J. H. M., San Francisco, Cal.



No. 255.—Automatic Lamp Cutout.

No. 256.—Formula for Air-Operated Device.—Please give a formula for calculating the power in watts of any air-operated device, if the air consumption in cubic feet of free air per minute and the air pressure are known.—A. F. A., Milwaukee, Wis.

The following formula gives the power represented by a given consumption of compressed air. Let P_1 equal atmospheric pressure, let P_2 equal pressure of compressed air, V equal volume of air used per minute in cubic feet.

The work done by each cubic foot of air in foot-pounds will be $P_1 \log_e P_2/P_1$, if the pressures are expressed in pounds per square foot. For one cubic foot per minute the watts will consequently be $746/33{,}000\ (P_1 \log_e P_2/P_1)$.

If P_1 is expressed in pounds per square inch and V cubic feet per minute are used, the total power will be in watts

$$3.26\ V P_1 \log_e P_2/P_1$$

$\log_e P_2/P_1$ means Napierian logarithm of ratio of pressures.—L. G. M., Chicago.

Electrical Engineering Problems.

By R. G. Hudson and W. V. Lyon.

DIRECT CURRENTS.

Problem 16.

Two shunt generators, A and B, are to be operated in parallel. The external characteristics of these generators may be represented by the equations, $V_A = 600 - 0.2I_A$ and $V_B = 580 - 0.1I_B$, where V_A and V_B represent the terminal voltages and I_A and I_B represent the line currents of the respective generators. Each machine can deliver continuously a current of 300 amperes without overheating.

Find (a) the line voltage when the line currents of the two machines are equal; (b) the line current of each machine when the total line current is 300 amperes; (c) the maximum power output of the two machines operating in parallel, and (d) the line voltage when no load is connected to the line wires.

ALTERNATING CURRENTS.

Problem 66.

A 25-kilovolt-ampere, 60-cycle autotransformer has a ratio of transformation of 660 to 220 volts. The core loss at the rated voltage is 368 watts. If the low-tension winding is short-circuited and 29.5 volts is applied to the high-tension winding, the current on this side is 40.2 amperes and the power is 348 watts. This transformer takes 22 kilowatts at 0.85 power-factor from a 660-volt circuit. (a) What are the currents on the high- and low-tension sides? (b) What power is delivered on the low-tension side? (c) What is the voltage on the low-tension side? (d) What is the power-factor on the low-tension side? (e) What is the efficiency of the transformer at this load?

SOLUTION OF PROBLEM 16.

Answer to Question a.

Graphical solution: The external characteristics may be plotted as shown in Fig. 16. Noting that the terminal voltages of two machines connected in parallel must be the same under all conditions, the further condition of equal line currents from the two machines is only realized at the point of intersection of the two characteristics. Hence, from Fig. 16, the terminal voltage, or line voltage, will be 560 volts and each machine will give 200 amperes to the line.

Mathematical solution: $V_A = V_B$, and since the currents, I_A and I_B, are to be equal, the subscripts may be omitted. Equating V_A and V_B, we have

$$600 - 0.2I = 580 - 0.1I.$$

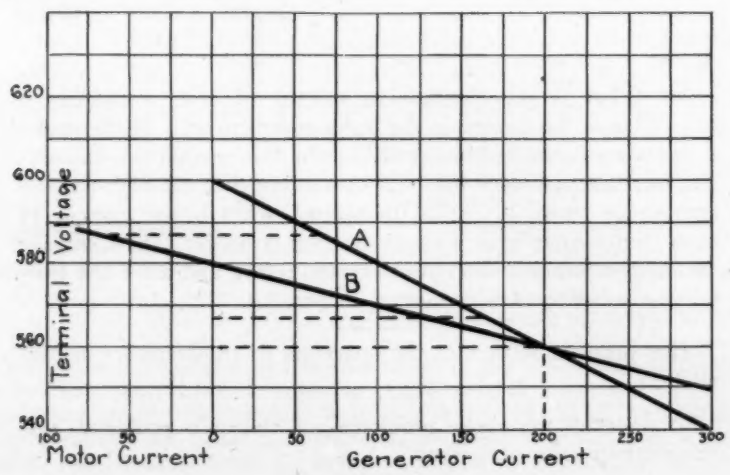


Fig. 16.

Solving $I = 200$ amperes.

Then $V_A = 600 - 0.2 \times 200 = 560$ volts.

Answer to Question b.

Graphical solution: Since $I_A + I_B = 300$ amperes, successive trials at different terminal voltages must be made until it is found that at some particular terminal voltage the sum of I_A and I_B is 300 amperes. In Fig. 16 it is found that at a terminal voltage of 567 volts, I_A equals 167 amperes and $I_B = 133$ amperes, and that the total line current is 167 + 133, or 300 amperes.

Mathematical solution: Two equations must be solved as follows:

(1) $600 - 0.2I_A = 580 - 0.1I_B$

(2) $I_A + I_B = 300.$

Solving, $I_A = 166.7$ ampere and $I_B = 133.3$ amperes. The terminal voltage equals $600 - 0.2 \times 166.7 = 566.7$ volts.

Answer to Question c.

From an inspection of the characteristic curves (Fig. 16) it may be observed that the current supplied by generator A cannot exceed 250 amperes since if A delivers a higher current than this B would become overloaded. The terminal voltage of either machine for maximum power output then equals $600 - 0.2 \times 250$, or $580 - 0.1 \times 300$, or 550 volts. Hence the maximum power output of each machine is given by [19]

$P_A = 550 \times 250 = 137{,}500$ watts.

$P_B = 550 \times 300 = 165{,}000$ watts.

Total maximum power = 302,500 watts, or 302.5 kilowatts.

Answer to Question d.

Graphical solution: Under the conditions of equal terminal voltages and total line current equal to zero, it may be seen from Fig. 16 that B must run as a motor. The current taken by B, moreover, must equal the current delivered by A, since the total line current is zero. Extending the external characteristic of B backward, a point on each characteristic is found at which the terminal voltages are the same and the currents are the same, but in opposite directions. As shown on Fig. 16, a terminal voltage of 587 volts satisfies these conditions, and the current delivered by A and supplied to B is found to be 67 amperes.

Mathematical solution: Since the currents are equal the subscripts in the external characteristic equations may be dropped, and since the current in B is reversed the terminal voltages may be equated as follows:

$$600 - 0.2I = 580 + 0.1I.$$

Solving, $I = 66.7$ amperes and the terminal voltage equals $600 - 0.2 \times 66.7$, or $580 + 0.1 \times 66.7$, or 586.7 volts.

It is obvious from the results obtained in Problem 16 that when two shunt gen-

erators are operated in parallel they will not divide the load evenly unless they possess external characteristics of the same shape and have the same no-load terminal voltage. With "drooping" characteristics as shown in Fig. 16, the two machines tend to share the load more equally than the results indicate. Generator *A*, for example, up to 200 amperes, supplies more of the load than *B*. The result is that the speed of the prime mover driving *A* tends to decrease slightly, which reduces the terminal voltage of *A* and in this manner reduces the load on *A*, transferring it to *B*. The deviation from the results obtained in the problem depends practically then upon the action of the governors controlling the speed of the two prime movers.

SOLUTION OF PROBLEM 66.

Answer to Question a.

The diagram showing the way in which the windings of an autotransformer are arranged is given in Fig. 15a. If N_1 and N_2 are the turns between *A* and *B*, and B and C, and I_1 and I'_2 are the currents in them, the same approximate relation exists between the currents and turns as does in a regular transformer.

By [39a] $I_1/I'_2=N_1/N_2$.

The current in the low-tension circuit

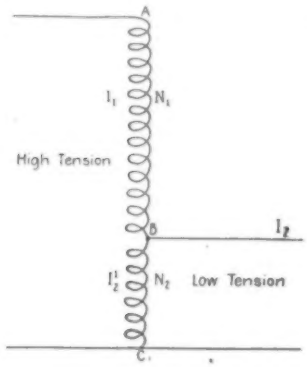


Fig. 15a.

is not I'_2, however, but is equal to I'_2+I_1. The current on the high-tension side is

By [1a] $I_1=22{,}000/(660\times0.85)$
$=39.2$ amperes.

The ratio of turns (N_1/N_2) is by [36a] equal to the ratio of the voltages across the coils.

$N_1/N_2=(660-220)/220$
$=2$

By [39a] $I'_2=39.2/2$
$=19.6$ amperes.

and $I_2=19.6+39.2$
$=58.8$ amperes.

Answer to Question b.

The power delivered on the low-tension side is equal to what is received from the high-tension circuit less the core and copper losses. The core loss is 348 watts and the copper loss is calculated, as in the case of the regular transformer, by multiplying the square of the current by the equivalent resistance. Both the cur-

DIRECT CURRENTS.

Problem 17.

Two short-shunt, compound generators are connected in parallel as shown in Fig 17. The resistances of the shunt and series fields respectively of the two machines are as follows:

	A	B
Shunt field	50 ohms	20 ohms
Series field	0.01 ohm	0.003 ohm

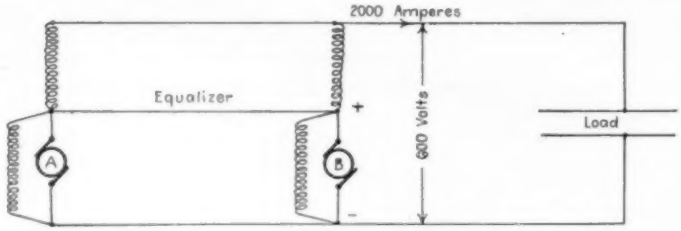


Fig. 17.

The difference of potential between the positive and negative busbars is 600 volts and the total current supplied by the two machines is 2,000 amperes. Neglecting the resistances of the busbars and equalizer, if the armature current of machine *B* is three times that of machine *A*, find (*a*) the current in the equalizer and its direction; (*b*) the armature current of *A*, and (*c*) the armature current of *B*. Find (*d*) the respective armature currents in *A* and *B* when the equalizer current is zero and the voltage and current supplied to the load are the same as shown in Fig. 17.

This problem illustrates the requirements for the stable operation of compound generators in parallel.

ALTERNATING CURRENTS.

Problem 67.

Two 500-kilovolt-ampere, 13,200:2,000-volt transformers of different design are connected to receive power from the same 13,200-volt circuit. On the low-tension side, however, they supply power to two independent circuits. The first transformer takes full-load current at 96 per cent power-factor from the high-tension circuit and the second takes full-load current at 82 per cent power-factor.

With the measuring instruments placed on the high-tension side, the short-circuit data for these transformers are:

	Amperes	Volts	Watts
No. 1	38	1,100	4,640
No. 2	38	414	3,390

(*a*) What is the low-tension voltage of each transformer? (*b*) What is the current in the high-tension circuit? If the transformers are connected in parallel on the low-tension side the second one becomes very hot. (*c*) Assuming that the high-tension current as found in (*b*) is unchanged, what is the current in each transformer when this connection is made? (*d*) Compare the copper losses in the transformers before and after the low-tension windings are connected in parallel.

This problem illustrates the operation of transformers in parallel.

Solutions of the above problems and two new problems will be printed in the next issue.

rent and equivalent resistance must be on the same side. The equivalent resistance on the high-tension side is

By [4a] $R_1=348/40.2^2$
$=0.215$ ohm.

The copper loss is then

$I_1^2R_1=39.2^2\times0.215$
$=330$ watts.

The total power loss is

$348+330=678$ watts.

The power delivered on the low-tension side is

$22{,}000-678=21{,}320$ watts.

Answer to Question c.

The method of calculating the low-tension voltage is like that used in the case of the regular transformer. See Fig. 16a. The high-tension current is taken along the horizontal axis. The equivalent impedance on the high-tension side is

By [3a] $Z_1=29.5/40.2=0.734$ ohm.

By [5a] $X_1=\sqrt{0.734^2-0.215^2}$
$=0.702$ ohm.

The horizontal component of the high-tension voltage is

$660\times0.85=561.$

The vertical component of the high-tension voltage is

$660\sqrt{1-0.85^2}$
$=660\times0.525=347.$

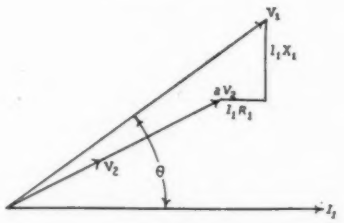


Fig. 16a.

The equivalent resistance and reactance drops are

By [22a] $I_1R_1=39.2\times0.215$
$=8.4$ volts.

By [23a] $I_1X_1=39.2\times0.702$
$=27.5$ volts.

The horizontal and vertical components of aV_2 are

By [19a] $(aV_2)_h=561-8.4$
$=553$ volts.
$(aV_2)_v=347-27.5$
$=319$ volts.

By [20a] $aV_2=638$ volts.

The ratio of transformation, a, is 3 and therefore $V_2=213$ volts. This is 7 volts less than it would be if the load were removed and the high-tension voltage unchanged.

Answer to Question d.

The power-factor on the low-tension side is

By [21a] $P.F.=553/638$
$=0.867.$

Answer to Question e.

The efficiency of any piece of apparatus is the useful power delivered divided by the power input. When possible it is best to calculate the output by subtracting the losses from the input. Or, if the output is given, it is best to find the input by adding on the losses. The output was calculated in **Question b.**

Efficiency$=21{,}320/22{,}000$
$=96.9$ per cent.

Vision and Illumination.

At a meeting of the Chicago Section, Illuminating Engineering Society, held in the Monadnock Block on the evening of December 18, Morgan Brooks, professor of electrical engineering at the University of Illinois, described a new form of illuminometer and spoke on "Vision and Illumination."

Various peculiarities of human vision were pointed out, such as the greater acuity near the center of the field of vision, the relation of size of pupil to intensity of illumination, the effects of flicker, glare, etc., and the inability to distinguish color at low intensities.

The illuminometer which was exhibited consisted of a cylindrical tube containing a dry cell and incandescent lamp. Light from the latter passed through a diffusing screen and the opening of an adjustable photographic shutter and fell upon a piece of black silk covering the opening in the end of the tube. The silk is thin enough to pass considerable light between its fibers, and its brightness as viewed by an observer, depends upon the size of opening of the shutter. The position of an index indicates the opening of the shutter, and the scale over which this index moves may be graduated in foot-candles after the instrument has been calibrated. Surrounding the silk is a comparison surface upon which the illumination to be measured is allowed to fall. An adjustment is made until its brightness is equaled by that of the silk. For convenience in estimating illumination of different color values, the comparison surface is divided into three portions of equal reflecting powers but different color values, one portion having a bluish tint and another a yellowish tint. The number of such sectors may be increased. The instrument was calibrated by illuminating it from sources of known intensity. The accuracy is of the order of 10 per cent. It is a convenient, portable and rapid instrument and gives comparative values, with all the precision desired in commercial work.

A model for demonstrating the principle was exhibited in which the current through the comparison lamp was varied by means of a rheostat. This obviates the use of the iris shutter, but is not so satisfactory on account of the color value of the lamp being variable.

J. R. Cravath, W. A. Durgin, M. G. Lloyd, Albert Scheible, C. A. Klise, H. S. Pardee, F. S. Hamilton and F. A. De Lay joined in the discussion. Sources of error in the illuminometer were pointed out to exist in the variability of the dry cell, lost motion between shutter and index, imperfect blackness of silk, thickness of silk and varying angle of view, screening of surface by observer and deterioration of comparison surface from dirt, etc. The Marshall illuminometer was said to have some similarity to it. Dry cells are more steady after delivering current for a few minutes than immediately after circuit is closed.

Mr. Cravath advocated the statement of brightness in terms of "apparent foot-candles."

Empire State Gas and Electric Association.

The first of the midyear meetings of the Empire State Gas and Electric Association was held in the Hotel Ten Eyck, Albany, N. Y., on December 10 and 11. There were between 50 and 60 present at the meeting. President J. C. DeLong called the first session to order at 2 o'clock on Thursday. The chief subject for discussion was the handling of complaints, both bill complaints and service complaints. The opening remarks were made by C. G. M. Thomas, who outlined the practice of his company in relation to these questions. He took up such questions as testing of meters, the adjustment of bills on account of fast and defective meters, the method of notifying the customer, as well as a number of other points closely related to the subject. Following Mr. Thomas, a number of others present outlined their methods and the general discussion consumed the entire afternoon session.

The meeting reconvened at 10 o'clock Friday morning when a further discussion took place in reference to the complaint question. It had been announced in advance that there would be one session for which there should be no specific subject and which should be open for the discussion of any subject that any of the members cared to present. Quite a number of interesting points were brought up in this open session, which lasted until 4 o'clock.

A suggestion was made to the Executive Committee that more uniform practice in adjusting bills in the case of wrong meters was desirable and that a tentative scheme might be prepared and distributed among the members for their criticism with beneficial results.

One of the subjects which received considerable attention was the matter of consumers' deposits and a plan was proposed of exchanging information in regard to customers who moved from one locality to another. The Executive Committee was also asked to take up this question.

LONG TRANSMISSION LINES.[1]

By R. A. Philip.

Two long transmission lines have recently been completed by the Stone & Webster Engineering Corporation. The first, from Keokuk to St. Louis, is 143 miles long; and the second, from Big Creek to Los Angeles, is 240 miles long. A comparison of these two lines shows how increased length modifies line phenomena and that line lengths are approaching a limit where ordinary methods of operation must fail.

The Keokuk line comes within the range of customary methods, but the electrical design of the Big Creek line presents a different plan of operation which indicates the direction in which the design of the longer lines of the future may be expected to tend as the new difficulties become more pronounced.

On long transmission lines it has been noted that the voltage at the delivery end has invariably been higher than at the generating end when the line is carrying no load. Theory indicates that this is also true for short lines but that the amount of rise is inappreciable and may, therefore, be neglected. Within ordinary ranges the rise increases as the square of the length of the line, that is, about 41 per cent increase in length doubles the rise.

The rise of voltage in a transmission line is a special case of what occurs when a relatively small condenser is charged with alternating current through an inductance. The voltage across the terminals of the condenser rises to a higher value than the applied voltage. The percentage rise obtained depends on the relative amount of capacity and inductance.

In a transmission line the percentage rise of voltage depends almost entirely on the length of line and the frequency. The resistance of the wire, its size and spacing are comparatively unimportant factors.

As lines grow longer, the capacity reactance decreases and inductive reactance increases with consequent increase in voltage rise. One particular length of line gives the relation which produces resonance. If voltage is applied to a line of this length it will build up indefinitely, that is, until something happens. The voltage may increase until the insulators arc over or puncture or the charging current may become great enough to burn out the generator. If the source of supply is feeble, the building up may be limited by the dissipation of the available energy in line loss.

The length of line which produces resonance depends on the frequency alone, that is, for each frequency there is a critical length where resonance occurs.

Electric phenomena are transmitted with the velocity of light, that is, about 180,000 miles per second. In an alternating current of 60 cycles per second, the front of a wave has one-sixtieth second start over the rear. With this start and traveling at 180,000 miles per second, the beginning of

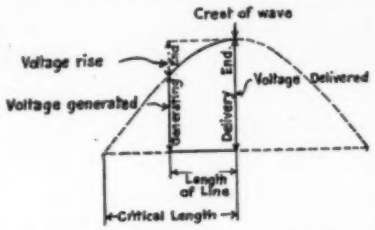


Fig. 1.—Relation of Generated Voltage to Delivered Voltage.

one cycle will be 3,000 miles away when a new cycle is ready to start. This is expressed briefly by saying that a 60-cycle current has a natural wave-length of 3,000 miles.

The length of line which produces resonance is found to be one-fourth of the natural wave-length; or 1,800 miles for 25 cycles, 900 miles for 50 cycles and 750 miles for 60 cycles. These lengths are then the critical lengths for these frequencies.

In a line of critical length ordinary methods of operation must fail, for it

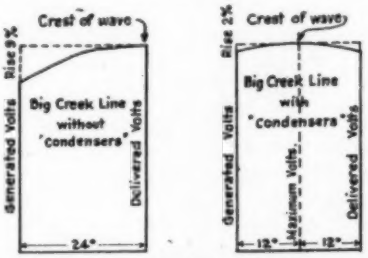


Fig. 2.—Characteristics of Loaded and Unloaded Line.

is impracticable to charge the line with the receiving end open. The critical length, therefore, furnishes a measuring stick for determining whether a line is long or short. When the critical length is so far off that it may be disregarded, the line may be classified as short; while a line long enough to require those precautions which are essential in the vicinity of the critical length is a long one. On this basis, the Keokuk line is short but the Big Creek line is nearly, if not quite, long.

In comparing the electrical characteristics of lines of different frequency the relative length in miles does not furnish as good a basis as the proportion each is of its respective wave-length. The wave-length is an inconveniently large unit so that, like a circular arc, it may be considered divided into 360 degrees to give a convenient unit. For electrical purposes the length of transmission lines, may, therefore, be better stated in degrees than in miles. At a frequency of 25 cycles each 20 miles is one degree of length and at 50 cycles each 10 miles is a degree.

On this basis of comparison, the length of the 25-cycle Keokuk line is about 7 degrees, and the 50-cycle Big Creek line about 24 degrees, the critical length in all cases being 90 degrees.

At no load the voltage rises along a transmission line in proportion to the sine wave, the delivery end always being at the crest of the wave. (See Fig. 1.) This makes the relation between generated and delivered voltage very simple. Taking the delivered voltage as unity, the generated voltage is proportional to the cosine of the length of the line expressed in degrees. As the cosine of 7 degrees is 0.99 and of 24 degrees is 0.91, it follows that the generated voltage is 99 per cent of the delivered voltage on the Keokuk line and 91 per cent on the Big Creek line.

Even on the Big Creek line the ratio of delivered to generated voltage is not so great as to require any extraordinary precautions. For longer lines the delivered voltage will increase to double and triple the generated voltage and at the critical length the ratio is as one to zero, that is, infinitely great.

The Big Creek line, therefore, differs from the Keokuk line, not in requiring new methods because of the rise in voltage, but in providing methods, though for other reasons, which would make the operation of a line of critical length possible.

The Big Creek line is a new departure in providing, at the delivery end of the line, synchronous condensers which are considered an integral part of the line design. In fact, the generators and condensers each with their voltage regulators are considered with the line as one unit of design. While the principal function of the synchronous condensers is to furnish leading current, thereby raising the voltage at the delivery end when the line is loaded, they have an almost equally important secondary function of furnishing lagging current for reducing the delivered voltage at no load. By raising the voltage at full load and lowering it at no load, the condenser makes it possible to maintain a constant voltage of 150,000 at each end of the line over the whole range of load. For present purposes it is sufficient to consider the effect of this plan at no load only.

With no load on the line (but with the synchronous condensers running,

[1] From *Stone & Webster Public Service Jonrnal.*

because they are to be considered as a part of the line itself and not an external load) half of the charging current of the line will come from the condensers and half from the generators. Under these conditions the crest of the sine wave of voltage is no longer at the delivery end of the line but is moved to the middle of the line as shown in Fig. 2. This change is equivalent to substituting two separate lines each 12 degrees in length for one 24 degrees long. The maximum voltage now occurs at the middle of the line and as the cosine of 12 degrees is about 0.98 the generated and delivered voltage will be about 98 per cent of the maximum. That is, the rise of voltage has been cut down from about 10 per cent to 2 per cent of the generated voltage.

As before stated, the length of the Big Creek line is not sufficient to make control of voltage rise necessary, but the radical nature of the step taken in providing such control is apparent in the case of a line of the critical length. Under ordinary operating methods the rise on such a line figures as infinite and its operation impossible. With a condenser at the delivery end as part of the line, the length of the line is virtually reduced from 90 degrees to 45 degrees. As the cosine of 45 degrees is 0.71 the voltage at the ends of the line will be 71 per cent of that in the middle, or the rise will be about 41 per cent of the terminal voltage; a large but not impossible amount. Without condensers the delivered voltage would be infinitely greater than the generated voltage, while with the condensers the voltage at the two terminals would be equal.

The Big Creek plan, therefore, makes possible the operation of lines of the critical length.

The controlling of voltage rise is but one of the useful functions of the condensers. In so far as they are used for this purpose, they are not so very different from reactance coils, and if this were their only function they might with advantage be replaced by such coils. That is, reactance coils connected in multiple with the transmission line at the delivery end or at intermediate points would properly hold down the voltage at no load, but would fail to raise the voltage at full load as is desirable.

Such reactive coils on a transmission line would be closely analogous to the loading coils used on telephone lines, the purpose being substantially the same; that is, to neutralize the effect of the distributed electrostatic capacity of the line by adding a partially distributed inductance.

On telephone lines the problem was met much earlier than on transmission lines because of the higher frequencies used and the greater lengths of line operated. Taking 500 cycles per second as an ordinary telephone frequency, the wave-length is but 360 miles and telephone lines over 2,000 miles long are in use. Thus telephone lines have already covered several complete wave-lengths, while transmission lines have not yet attained a length of one-quarter of one wave.

It appears that the long transmission line, like the long telephone line, will differ from the short line in being "loaded." The problems of "loading" transmission and telephone lines are not quite identical, so that somewhat different solutions may be expected. The Big Creek line is probably the first systematically "loaded" power line and indicates that power-line "loading" practice will diverge from telephone practice from the beginning. Telephone lines are "loaded" with coils of fixed inductance while power lines will probably be "loaded" with synchronous machines which will act as inductances at no load and as condensers at full load.

The Big Creek line is "loaded" at its terminals only and this is sufficient, as the line covers only about one-seventh of a wave-length. On longer lines intermediate "loading" may be desirable. For example, the quarter-wave-length line has a rise of 41 per cent at the middle when "loaded" at the terminals. An additional "loading" at the middle would reduce this to about 8 per cent.

On still longer lines resonance may occur even with terminal "loading" so that intermediate "loading" will then be essential. Thus a line covering a half-wave-length may act as two lines of a quarter-wave-length if "loaded" at the terminals only. The voltage at the middle point would then build up indefinitely unless restrained by intermediate "loading."

Land-Grant Colleges to Establish Wireless Stations.

Prof. J. A. Thaler, formerly of Minneapolis and now in charge of electrical engineering work at Montana State College, is endeavoring to affect an organization of the men in charge of electric work at land-grant colleges and to form a system of college wireless telegraph stations. To that end, he is consulting with Prof. George D. Shepardson, head of the electrical work at the University of Minnesota, for the purpose of arranging a meeting of the men who would be most interested in such a project, the meeting to take place in Minneapolis during the Christmas holidays.

The purpose is to discuss the feasibility of such a scheme, make plans and, if possible, draw up a constitution and effect a permanent organization. A wireless station was recently put in operation at the Minnesota University, and similar stations have been added, or are contemplated, as part of the equipment of other universities of the middle west. Professor Thaler believes that co-operation in the exchange of messages between such stations would stimulate interest in the study of wireless telegraphy.

Practical Telephone Work for Technical Students.

The training of the modern technical student can no longer be considered complete or even useful with merely a theoretical foundation. He must also be instructed in the practical phases of the work. Recognizing the fact that text books must be supplemented by actual working knowledge, the University of Iowa is planning to install a complete Western Electric telephone central-office equipment which is to be used exclusively for the benefit of the technical students in demonstrating the operation of a telephone central office.

The switchboard, which is of the central-battery non-multiple type, will have an equipment of 20 common-battery lines, 5 magneto lines, 4 common-battery cord circuits and 3 combination cord circuits. Each of the latter will be equipped for different types of ringing, such as two-party, four-party pulsating, one-way ringing, two-way ringing and all of the other combinations usually found in a telephone central office. For use in connection with this switchboard there will be a main distributing frame and a complete protector equipment. A testing cabinet will also be furnished and by means of this all of the tests usually made by a wire chief can be duplicated. There will also be a number of modern telephones connected to the switchboard. These will include a number of metal-type wall sets, several desk telephones and the folding-gate telephone bracket.

Students will be instructed in switchboard operating, wiring and trouble hunting. In fact, every branch of telephone operating and maintenance work will be demonstrated.

Characteristics of Ductile Tungsten.

Ductile tungsten is practically insoluble in all the common acids; its melting point is higher than that of any other metal, its tensile strength exceeds that of iron and nickel, it is paramagnetic, it can be drawn to smaller sizes than any other metal (0.0002 inch in diameter), and its specific gravity is 70 per cent higher than that of lead.

A LAMP SLIP INDICATOR.

By Frederick Bedell.

The following device has been used for indicating the slip of an induction motor direct-connected to a direct-current generator provided with a derived neutral. It can also be used for indicating the slip of an induction motor direct-connected to a synchronous alternator, *i. e.*, a frequency changer.

An incandescent lamp is located in a magnetic field of one direction, obtained by placing the lamp near a permanent magnet or suspending it in the stray field from the generator poles. Through the lamp are passed two superposed alternating currents, one of these currents being supplied by the line and having line frequency, the other being taken from the slip-rings of the generator and having a frequency proportional to the speed of the generator and motor. If there were no slip, the ratio of these frequencies would be the ratio of the number of poles in the two machines. The resultant alternating current would then be periodic, repeating itself one or more times each revolution. On account of slip, however, there is a gradual shifting in the relative phase positions of the two currents and this produces an effect somewhat like beats. This produces regular pulsations in the lamp filament, as it vibrates in the magnetic field. These pulsations indicate the slip.

The motor-generator on which this device has been used consists of an eight-pole induction motor on a 60-cycle circuit and a four-pole generator producing alternating current with a frequency just under 30 cycles. The two alternating currents were derived through insulating transformers before combining.

The reverse arrangement can be used, namely a direct-current incandescent lamp can be placed near a solenoid carrying the two superposed alternating currents. Or, as a modification, one alternating current can be passed through the lamp, or solenoid, the other alternating current, with superposed direct current, being passed through the solenoid (or lamp). The effect is very pronounced in some of these arrangements and not in others. The arrangement first described is simplest, as it requires the use of only two currents. In this case the pulsations give the effect of a phantom filament swinging back and forth synchronously with the slip. In other cases the pulsations produce rythmic variations in the amplitude through which the lamp filament vibrates. With the apparatus used, these were found most pronounced and easy to read when current of the lower frequency was passed through the solenoid and current of the higher frequency, with direct current superposed, was passed through the lamp. With the direct current omitted, the effect was discernible. The foregoing device was first used by the writer about ten years ago.

Successful Safety and Sanitation Conference.

A safety and sanitation conference, in connection with the Second Exposition of Safety and Sanitation, was held at the Grand Central Palace, New York, December 14-19. The conference and exposition were under the auspices of the American Museum of Safety, of which Arthur Williams, general inspector of the New York Edison Company, is president, and Dr. William H. Tolman is director. Sessions were held daily, and there were presented a number of addresses relating to civic and industrial methods for preventing accidents and eliminating life and property hazards of every description. In connection with the exposition, several large railroads took a leading part, the New York Central, the Union Pacific and the Southern Pacific making extensive exhibits of safety devices. The New York Edison Company and the Westinghouse Electric and Manufacturing Company contributed generously to the exposition in the form of industrial appliances for increasing the safety of the workman and the consumer.

In recognition of interest taken in safety and sanitation, gold medals were awarded to J. D. James, of the New York Zinc Company; Dr. Philip Rauer; D. M. Holman, of the Massachusetts Museum of Safety; Lieutenant Edmunds, of the United States Navy; Mrs. Philip Lydig and Miss Graham Mulhall; R. W. Campbell and L. Palmer, of the National Safety Council; F. H. Fairbairn, vice-president of the Diamond Match Company; Thomas B. Murray, of the New York Edison Company, and Arthur Williams, president of the American Museum of Safety.

Louisville Electrical Men Discuss the Code.

The fire hazard from the electrical angle as compared with other hazards was discussed at length at a recent joint meeting of the Louisville Clearing House and the Jovians, held in the Assembly Hall of the Louisville Gas and Electric Company, with W. G. Gilsdorf, representing the Commercial Union Fire Insurance Company, at Lexington, Ky. Mr. Gilsdorf, formerly head of the Lexington branch of the Kentucky Actuarial Bureau's electrical inspection department, spoke in strong approval of the Electrical Code and inspections.

It is to the provisions of the Code and the stringent inspection, he said, that the low ratio of fires chargeable to electrical installations is due, citing the fact that two and one-half per cent of fires from all causes are due to defective electrical installations, while other hazards run as high as 10 per cent. There was occasionally a disposition to criticize the stand taken by inspectors of electrical work, he said, but he pointed out that though the requirements of the Code were severe, now and then the result was altogether in favor of the electrical contractor inas much as it insured safey of electrical installations. Without the Code and inspections fires chargeable to electrical origin would be very much more frequent, he declared.

National Electric Light Association and American Institute Sections Hold Joint Meeting.

A gathering, unique in the annals of National Electric Light Association section meetings, was that held on Tuesday evening, December 15, at South Bethlehem, Pa., when the Lehigh Valley Light and Power Company section held a joint meeting with the Lehigh University Electrical Society, a branch of the American Institute of Electrical Engineers, in the Physics Laboratory Building. Committees headed by Chairman N. F. Matheson of the students' organization, and Chairman Irving Samuels of the National Electric Light Association section, made all arrangements for the affair and that their efforts were amply rewarded was shown by the large attendance.

About 130 members, equally divided between the two bodies, listened with great interest to the address of T. C. Martin, executive secretary of the National Electric Light Association, who laid especial emphasis on the advantages to be derived from the interchange of ideas between the technical and the practical divisions of the industry, typified by the audience present. Mr. Martin entertained his listeners with many reminiscences of his experience in the early days of electricity, his connection with the profession dating from 1877 when he worked side by side with Thomas A. Edison in the latter's laboratory at Orange, N. J.

Prof. W. S. Franklin, of Lehigh, conducted several very interesting electrical demonstrations supplemented by detailed explanations and drawing unreservedly on his vast knowledge of the subject.

After the formal addresses, a Welsh rarebit lunch was served in the banquet hall, followed by a musical program interspersed with short remarks by A. H. S. Cantlin, vice-president of the Lehigh Valley Light and Power Company, D. M. Petty, electrical superintendent of the Bethlehem Steel Company, and by Prof. William Esty, of Lehigh. All expressed satisfaction with the success of this initial joint meeting and added their hopes for many repetitions along the same lines in the future.

Relief, Compensation and Pension System for Westinghouse Employees.

The Westinghouse Electric & Manufacturing Company has just issued a preliminary statement of its sickness and accident relief, accident compensation and service pensions on which its officers have been working for over a year. The plan includes three separate and distinct features: (1) Extension of the present relief department. (2) An accident and compensation plan. (3) Service pensions.

Relief Department.—The privileges of the relief department are open to every employee, male or female, regardless of age, position or location, upon payment of small monthly dues. The company pays the entire expense connected with the operation and maintenance of this department, the dues being reserved wholly for the payment of benefits (proportioned to wages) for sickness and accident arising from causes other than employment. In the event of death the amount paid from the dues will be duplicated by the company which will also meet any deficit that may arise. Benefits will continue as long as disability lasts, or until the age of 70 years is reached, when pensions will be granted.

Accident Compensation.—An accident compensation fund is maintained entirely by the company for the benefit of all employees, male or female, whether they belong to the relief department or not. This plan covers the payment for disability due to accident, or for death resulting from accident, while at work as an employee, and makes provision for both total and partial disability. In case of total disability the company will pay as long as the disability lasts, even for life, two-thirds of the average wages received, and for partial disability, two-thirds of the reduction in the earning capacity of the employee, even though the employee should eventually leave the service of the company. In case of death the company will immediately pay the dependents, or next of kin $150, as explained under the provisions of the plan, as a pension to the widow or dependent husband or children under 16 years of age. Medical, surgical and hospital expenses under the direction of the company's medical officers will be paid during disability from such accidents.

Pensions.—Employees of the company shall be retired at the age of 70 years, and those who at the time of such retirement are members of the relief department, and have completed at least 20 years of continuous service are to be granted a pension amounting to one per cent of the average monthly wages during the last 10 years of employment for every year of continuous service, with a minimum of $20 per month and a maximum of $100 per month.

Upon the death of a pensioner, one-half of the pension will be paid to the widow until remarriage, providing marriage occurred at least 10 years before the granting of the pension. For the support of each child under 16 years of age, and for each wholly dependent grandchild under 16 years of age, one-fourth of the pension will be paid until they reach the age of 16 years.

The president of the company may, at his discretion, retire any employee between the ages of 60 and 70 years who has been in the service the required time, and he may increase any pension for specially meritorious service, by 25 per cent, but not beyond the maximum pension of $100 per month.

In those states already having workmen's compensation laws, as in the case of New Jersey and Ohio, where the company also maintains plants, such laws may be substituted in whole or in part. Where the provisions of the Westinghouse plan are more liberal these will generally prevail.

Research Fellowships in the Engineering Experiment Station, University of Illinois.

To extend and strengthen the field of its graduate work in engineering, the University of Illinois has since 1907 maintained ten research fellowships in the Engineering Experiment Station, Urbana, Ill. These fellowships, for each of which there is an annual stipend of $500, are open to graduates of approved American and foreign universities and technical schools. Appointments to these fellowships are made and must be accepted for two consecutive collegiate years, at the expiration of which period, if all requirements have been met, the Master's degree will be granted. Not more than half of the time of the research fellows is required in connection with the work of the department to which they are assigned, the remainder of the time being available for graduate study.

Nominations to fellowships, accompanied by assignments to special departments of the Engineering Experiment Station, are made from applications received by the director of the Station each year not later than the first day of February. These nominations are made in February by the Station staff, subject to the approval of the faculty of the Graduate School and the president of the University. Appointments are made in March, and they take effect the first day of the following September. Four vacancies are to be filled at the close of the current academic year.

Nominations to these fellowships are based upon the character, scholastic attainments, and promise of success in the principal line of study or research to which the candidate proposes to devote himself. Preference is given those applicants who have had some practical engineering experience following their undergraduate work.

The Engineering Experiment Station was established in 1903 for the purpose of carrying on investigations in the various branches of engineering, and for the study of problems of importance to engineers and to the manufacturing and industrial interests of the state. Research work may be undertaken in architecture, architectural engineering, chemistry, civil engineering, electrical engineering, mechanical engineering, mining engineering, municipal and sanitary engineering, physics, railway engineering, and in theoretical and applied mechanics.

Additional information may be obtained by addressing Dr. C. R. Richards, director of the Engineering Experiment Station.

Contractors' 1915 Convention.

The next annual convention of the National Electrical Contractors' Association of the United States will be held at the Auditorium, San Francisco, Cal., July 18 to 24, 1915. Headquarters will be at the Clift Hotel, Geary and Taylor Streets.

A special train will be run from the East, arriving on Sunday, July 18. Monday will be devoted to sight-seeing. On Tuesday there will be meetings of the Board of Directors and of the Executive Committee.

An open session will be held on Wednesday morning, with addresses by President Galloway, Mayor Rolph, John A. Britton, W. S. Goodwin and others. Business sessions will be held on Wednesday afternoon, Thursday morning and afternoon and Friday morning.

Various entertainment features are being arranged, including a steamer trip around San Francisco Bay on Saturday.

ELECTRICAL MANUFACTURERS DISCUSS CHEAPER WIRING.

Committees Representing Various Interests Appointed to Investigate and Confer with Proponents of Cheaper System of Electrical Installation.

(By Special Telegraph.)

NEW YORK, December 22.—The proposal upon the part of the Committee on Wiring of Existing Buildings of the National Electric Light Association for an investigation of ways and means for securing a reduction in the cost of electrical wiring, without increasing the hazard to life and property, and which has resulted in the suggestion that the concentric system of wiring be adopted, was the subject of discussion at a mass-meeting of manufacturers of electrical wiring devices, electrical supply jobbers and contractors at the Biltmore Hotel, to-day.

About 150 representatives were present, and the meeting was called to order at 10 a. m. by C. E. Corrigan, vice-president and general manager of the National Metal Molding Company, of Pittsburg, who suggested George A. Cragin, general sales manager of the American Steel and Wire Company, of Chicago, as chairman of the meeting. Mr. Cragin was unanimously elected, and Mr. Corrigan and George H. Duffield, secretary of the National Electrical Contractors' Association, were elected vice-chairman and secretary, respectively.

The chairman called upon Charles L. Eidlitz to state the object of the meeting.

Mr. Eidlitz said, in part: "This meeting has been called because some one yelled 'fire.' A committee was appointed by some one (I do not know who) consisting of W. H. Blood, Chairman, and Messrs. Lawler, Sargent, Forsythe, Devereux, Paddon, Strong and Dana Pierce as members, for the purpose of investigating a new method of wiring. This related particularly to small houses, tenement quarters and places of the kind that use no electric light because they can not afford it, because they can not pay for the wiring. The method investigated consists of ordinary circuit wire, No. 14, covered with insulation (and from the looks of it, not very good insulation), having on the outside a metal sheath soldered at the joint; in other words, watertight. This committee investigated and reported favorably to the Underwriters. How far the Underwriters expect to go in approving the material I do not know. The general impression is that it is to be used only for 660 watts. I understand, however, that at the meeting of the Underwriters' committee next March, a report is to be sent in, and should the committee recommend its adoption, it will, of course, carry considerable weight with the Underwriters. Should this be adopted it would have a very serious effect upon nearly everybody's business in the electrical line. The wire manufacturer and the manufacturer of all kinds of appliances—sockets, panels, cutouts, switchboards and conduits. Anybody who builds in any way on the basis of two connections would have to change his method of construction for one connection. The electric lighting companies would be affected favorably, and so would the manufacturer of electric lamps. The electrical contractor's business would be cut immediately very seriously. If this kind of stuff is safe, you will not need a contractor or mechanic. The third man, chauffeur or the cook can do the work. The electrical supply man would have to scrap a lot of his material and buy new stuff. The whole proposition is a complete reversal of everything that has been going on for the last few years, for the Underwriters said 'More insulation, better insulation,' etc. Now, all of a sudden, out of a clear sky, 'No insulation, only one wire, ground everything—that will be a fine system.' I presume some one has called this meeting for the purpose of having you know what it is all about. It is up to this meeting to decide what is to be done, whether this new wire is good stuff, and is all right."

The chairman then called upon Wallace Clark, of the General Electric Company, who said: "For a number of years the lighting companies have put pressure on the General Electric Company, and I presume upon other manufacturers as well, for some sort of a cheaper system of lighting for the outskirts for cheaper houses. About a year ago Mr. Doane and Mr. Hale came to us and said, 'We must have a cheaper system. We must reach a large number of customers we can not touch now.' We looked the matter over and decided that the so-called Stannos wire system was as good a system as we could find. Then our Mr. Sargent sketched out the fittings and our patent attorney said we might get a few detail patents, but no basic patents on them. Therefore, I think anybody is free to make the fittings. About a month ago, we took a sample board to the committee referred to, but I have not seen the report. If the system were adopted, it should be very restricted in use. If in March this scheme should go through with the Underwriters, I think we would be practically in the same position as all other manufacturers; that is, we would have to design and build machinery to make wire, special fittings, etc. I will say, frankly, that we were surprised that the insurance people seemed to view the system favorably."

H. B. Crouse said he did not think that the General Electric Company should be criticised, as perhaps some thought they should be from the information that had been received. Perhaps they were further along in these matters than the rest, due to their closer connection with the central stations and the lamp business.

Ernest McCleary and J. R. Strong called attention to the objectional features of the new wire and its effect on electrical contractors, and W. W. Low, of the Electric Appliance Company, Chicago, spoke at some length as to the unfavorable effect it would have upon the electrical jobbers and suggested the appointment of a general committee.

Dr. S. Trood, of Newcastle, Pa., a Russian engineer, stated as his opinion that the system proposed in the United States would be hazardous.

Leroy Clark, speaking for the insulated wire manufacturers, favored the appointing of a committee to confer with the committee of the National Fire Protection Association, of which W. H. Blood, Jr., of Boston, is chairman. Mr. Clark believed that the patent situation was open and that anybody could make the fittings.

The chairman called upon John R. Galloway, president of the National Electrical Contractors' Association, who said:

"The proposition is a big one and only a few have had opportunity to consider the question properly. I think Mr. Low has hit upon a happy thought and I favor the appointment of a committee of all interests affected to thoroughly discuss this question and report at a later meeting. I see no necessity of placing the proposition on the Empire Express or the Black Diamond and rushing it through to the destruction of other interests.

R. B. Benjamin, of the Benjamin Electrical Manufacturing Company, Chicago, said the fittings end is the important one, and the uncertain one. The question is how many manufacturers would be able to put out a line of fittings that would be suitable If the system is a good one, we ought to have a reasonable time, and likewise all of the contractors, so as to adjust ourselves to the new condition, if that new condition is desirable and necessary.

Mr. Crouse moved that the chair be empowered to appoint a committee representing all the interests present at this meeting.

Mr. Corrigan said: "We are all of one mind, and that is that we have found the representatives of the Underwriters fair men, honest men, and I believe the subject of this meeting has

not been properly presented to them as showing the feeling of the electrical trade here represented. I would suggest a subcommittee to confer with Mr. Blood's committee. We should have time to carefully consider and know all about this question. It can not be done in the 60 days which elapse between now and March, the time of the meeting of the Electrical Committee of the Underwriters' Association, at which time action is probable on this matter. I would suggest that whatever committee is appointed it should request delay in this report to become more familiar with the subject."

Mr. Pringle, of Philadelphia, spoke emphatically against the new wiring system, and Mr. Parker, of Boston, said that the new system would virtually destroy the manufacture of standard electrical porcelain.

A question was raised regarding the rules of the Underwriters, that if this matter is put off next March, it is put off for two years and suggested that the committee request this postponement.

The chairman stated, in reply to an inquiry, that under the present high-grade insulation where wiring a house would cost $62, under the new plan it could be done for about $28.

F. V. Burton suggested that there should be added to the committee a representative of consulting engineers and his suggestion was adopted.

The chairman said: "In respect to the committee, as I understand it, it is to make an efficient investigation, report as fully as possible to a meeting of this body which shall be called for February 9 next, and in the meantime confer through a subcommittee with Mr. Blood's committee, and endeavor to secure a postponement of any action on the part of that committee for the present, at least."

The chairman put the motion, which was unanimously carried on motion of Mr. Pringle, as amended by Mr. Eidlitz, it was voted as the sense of the meeting that the committee to be appointed shall strongly oppose any radical change in the method of wiring at the next session of the Underwriters. The meeting then adjourned at 12:50 p. m.

The committees appointed were as follows:

Charles L. Eidlitz, Metropolitan Electric Manufacturing Company, Long Island City, N. Y., was made chairman of the general committee with the following members representing the several lines of manufacturers interested:

Wire—W. A. Conover, Standard Underground Cable Company, Perth Amboy, N. J.; F. K. Sheppard, B. F. Goodrich Company, Akron, O.; George A. Cragin, American Steel and Wire Company, Worcester, Mass.

Conduit—C. E. Corrigan, National Metal Molding Company, Pittsburgh; F. C. Hodkinson, Safety Armorite Conduit Company, Pittsburgh; L. J. Campbell, Western Conduit Company, Youngstown, O.

Fittings—H. B. Crouse, Crouse-Hinds Company, Syracuse, N. Y.; W. T. Pringle, Pringle Electric Manufacturing Company, Philadelphia, Pa.; A. W. Berresford, Cutler-Hammer Manufacturing Company, Milwaukee, Wis.

Porcelain—Herbert Sinclair, Star Porcelain Company, Trenton, N. J.; J. E. Way, R. Thomas Sons Company, New York City.

Boxes—R. B. Corey, Pratt Chuck Company, New York City.

Sockets—W. C. Bryant, Bryant Electric Company, Bridgeport, Conn.

Fuses—E. B. Hatch, Johns-Pratt Company Hartford, Conn.; L. W. Downs, D & W Fuse Company, Providence, R. I.; Bryson D. Horton, Detroit Fuse and Manufacturing Company, Detroit, Mich.

Jobbers—Frank S. Price, Pettingell-Andrews Company, Boston, Mass.; E. W. Rockafellow, Western Electric Company, New York City; W. W. Low, Electric Appliance Company, Chicago.

Electrical Contractors—Ernest Freeman, Freeman-Sweet Company, Chicago; John R. Galloway, Washington, D. C.; John Livingstone, J. Livingstone Company, New York City.

Electrical Engineers—Gano S. Dunn, J. G. White & Company, New York City.

Fixtures—Louis McCarthy, Macallen Company, Boston, Mass.; R. B. Benjamin, Benjamin Electric Manufacturing Company, Chicago.

Special Sub-committee, to confer with Underwriters' representatives—H. B. Crouse, C. E. Corrigan, R. K. Shepherd, Ernest Freeman, Frank S. Price.

C. W. P.

Gasoline Fires Caused by Frictional Electricity.

Several fires of mysterious origin in garages have been finally traced to ignition by a spark of static electricity generated by the friction of gasoline when it is poured into the tank of the automobile. For a long time no reason could be given for certain fires in garages, where there was good evidence that an open flame or electric wires were not a factor.

During last April a fire occurred at the Cambridge Garage of the Metropolitan Park Commission, which was carefully investigated by Walter Wedger, chemist for the Detective and Fire Inspection Department of the Massachusetts District Police. In this instance a car was being filled with gasoline, which was poured into a funnel through a chamois skin strainer from a five-gallon can. The funnel would not sit upright in the hole of the tank, and to overcome this difficulty a wooden ring was first placed in the filler hole and the funnel set in this. In this way the wood insulated the funnel from metal of the tank. After pouring some gasoline through the chamois skin, the man brought the pouring can near to the metal edge of the funnel, and a spark jumped from the car to the funnel, igniting the gasoline vapor. The prompt use of extinguishers saved the car from serious damage. This man insisted that he heard the spark. It was then decided to try and duplicate these conditions and make several tests. A number of engineers and other interested people were invited by Mr. Wedger to witness these tests. Gasoline was poured through a chamois skin covered funnel insulated from the floor of the garage, and a spark obtained. Several experiments were tried, and a gold leaf electroscope, which was used to locate a charge of static electricity, showed it to be present in considerable quantity. The funnel, which was painted on the outside, was placed in the tank of the car without the wooden block, and the experiment repeated. The size of the charge was considerably less, and when it was again tried with the paint removed so that the funnel made a good contact with the metal of the tank, the electroscope did not show any static charge present.

Various other tests were made which convinced those present that gasoline poured through a non-conductor of electricity did generate frictional electricity, and as the chamois skin was such a non-conductor, electricity was generated by pouring the gasoline through the chamois. Gasoline, unlike water, is a non-conductor of electricity.

If the non-conductor is in contact with the ground or a large metallic body, the amount of static electricity generated will be absorbed and does not make its presence known. However, if the non-conductor is in contact with only a small amount of metal, as a funnel or a faucet, this metal becomes highly charged with electricity and will discharge with a good-sized spark if another metallic substance is brought in contact with it or very close to it. Consequently in this fire the funnel, being insulated by the wooden block, became charged, and when the metal pouring can was brought near it, it discharged with a spark of sufficient intensity to ignite the gasoline vapor.

Several other fires which were caused by frictional electricity have come to the attention of the Massachusetts District Police.—*Quarterly of the National Fire Protection Association.*

Institute Branch in Alabama.

The Board of Directors of the American Institute of Electrical Engineers has authorized the formation of a University Branch at the University of Alabama, Tuscaloosa, Ala.

BOOK REVIEWS.

"Principles of Electrical Measurements." By Arthur Whitmore Smith. New York: McGraw-Hill Book Company, Incorporated. Cloth, 243 pages (5x7½ inches), 99 illustrations. Supplied by the Electrical Review Publishing Company, Inc., for $2.00.

Some 20 years ago Professors Carhart and Patterson of the University of Michigan wrote a book on electrical measurements which has been used extensively both in physics and electrical engineering laboratories, but mainly in the former. This was a most excellent book for its time and served its purpose well. Naturally, however, with new developments, and newer methods of presenting the subject, a new book was felt to be necessary. The book before me is an attempt to remedy some of the pedagogical defects in the older book and to give some consideration to more recent developments as well as to present some new methods of measurement. The text is divided into 15 chapters, and the scope of the book will be disclosed to some extent by their headings which are: Units and Definitions; Ammeter and Voltmeter Methods; Ballistic Galvanometer and Condenser Methods; The Current Galvanometer; Wheatstone Bridge; Measurement of Current; Potentiometer Methods; Measurement of Power; Measurement of Capacity; The Magnetic Circuit; Definition of Maxwell; Magnetic Tests of Iron and Steel; Electromagnetic Induction; Measurement of Self and Mutual Inductance; Alternating Current.

In the preface the author states that "the book is arranged on the progressive system. The simpler and more fundamental parts of the subject are taken up in the first chapters, and in the first part of each chapter, while the more difficult measurements and the methods involving more extended knowledge are reserved until the student has attained greater proficiency."

It is thus evident that the basis of classification has been the degree of difficulty and not the quantity measured. This plan of presentation has not, however, been consistently followed throughout. For example, the measurement of power with a wattmeter is much simpler and easier than the measurement of resistance by means of a differential galvanometer. The former is given on page 121 while the latter is described on pages 56 and ff. While the method of classification proposed by the author has much in its favor from a pedagogical viewpoint, nevertheless it leads to some illogical classifications. Thus Chap. I is devoted to "Ammeter and Voltmeter Methods" and in this chapter the use of the ammeter in the measurement of current is explained. Chap. VI is headed "Current Measurement," but instead of describing methods of measuring current, the whole chapter is devoted to a description of some of the more common electrical measuring instruments. The more logical system of classification is followed in the later chapters.

The reviewer knows from practical experience how difficult it is to avoid mistakes and errors in the first edition of a book and accordingly he wishes to compliment both the author and the publishers on the scarcity of errors in the text. Nevertheless, one or two may consistently be pointed out for they do not seem to be mere oversights. Thus, on page 10, the author speaks of using a key with an ammeter, and suggests that the key be tapped to determine whether an excessive current is likely to flow. The use of a key with an ammeter is hardly to be recommended, and a short-circuiting switch for the ammeter will serve much better to protect it. Then on pages 225 and 226 it is stated that alternating-current ammeters "indicate the square root of the instantaneous values of the current. This value is often called the 'mean square value' for short." In this statement there seems to be two fallacies. In the first place an instrument of the type described does not indicate the square root of the instantaneous values, but the square root of the mean of the squares of the instantaneous values. In the second place it is seldom or never called the "mean square" value, but "root mean square" or "effective" value.

There are many features of the text which seem to the reviewer worth commending. Among the most prominent may be mentioned the clear treatment, and logical development of the mathematical relations; the discussions of Kirchhoff's laws are exceptionally good. Any student who will master the first five sections of Chap. VII cannot help but get a good understanding of these useful laws. The same praise can justly be given to most of the definitions, although in a few instances they seem incomplete. For instance, Ohm's law is treated as though it applied to direct circuits only; and again, in defining electromagnetic induction, the author leaves the impression that it is synonymous with mutual induction. The explanations of the application of the Wheatstone's bridge in locating faults is excellent and useful.

Since most of the methods of measurement described may properly be called laboratory methods, as they can be performed in only well equipped laboratories, it seems unfortunate that the author did not consider it worth while to include a treatment of the Kelvin double-bridge method of measuring resistance.

The reviewer has enjoyed reading the book, and wishes to congratulate the author for producing a teachable text, one that may be safely recommended to instructors in fundamental electrical measurements.

C. M. JANSKY.

"Experiments." By Philip E. Edelman. Minneapolis: Philip E. Edelman. Cloth, 256 pages (5¼x7¾ inches), illustrated. Supplied by the Electrical Review Publishing Company, Inc. for $1.50; bound in leather, $3.00.

This volume is divided into two parts, the first indicating how a number of instructive experiments may be carried out by the beginner in the realms of chemistry, electricity and other fields. Most of the chapters deal with electrical experiments, and directions are given for the construction, as well as the use of the necessary apparatus, so that an extensive outfit is not necessary to undertake this excursion into direct personal experimentation or investigation of nature's ways. The second part comprises a somewhat philosophical introduction to invention. The author elucidates the principles of research and explains how it should be conducted. To the amateur in this field the book should be a help and an inspiration. It is somewhat unique in its aim, and the author has brought originality and ability to the problem of presenting a subject in which he has evidently had experience. To the teacher of laboratory science also it should be suggestive.

"Dialogues Concerning Two New Sciences." By Galileo Galilei. Translated from the Italian and Latin into English by Henry Crew and Alfonso De Salvio. New York: The Macmillan Company. Heavy cardboard, 300 pages (7x9 inches), illustrated. Supplied by the Electrical Review Publishing Company, Inc. for $2.00.

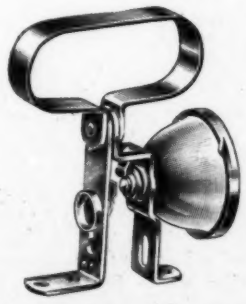
This book represents a summary, written by Galileo while in prison near the close of his life, of his investigations in the subjects of strength of materials, cohesion, rectilinear motion and the motion of projectiles. To each subject is assigned one day of dialog, and this treatment permits explanations to be made which greatly help the elucidation of the subject. About all that Galileo developed in dynamics is brought out in these dialogs and the literary style and genius of the author are such as to make them very interesting reading. The translation has been made in a scholarly manner, giving a modern interpretation to the words used in the original, so that the text shall be technically intelligible. For a period not familiar with modern scientific methods of experiment, Galileo's initiative along this line was remarkable, and his experiments as well as his statement of underlying principles hold the reader's attention. The original illustrations are reproduced, and the printing is excellent. This volume is a notable addition to English history of physics and should be especially valuable to teachers and students of mechanics.

New Electrical and Mechanical Appliances

Redsealite Portable Electric Lantern.

Of the handy electric lanterns that are now being put out in such great variety and quantity, one of the most popular is the new Redsealite outfit, illustrations of which are shown herewith. This is a very simple and compact equipment that can be readily attached to any No. 6 dry cell, although it was designed primarily for use with the Red Seal dry battery, which has flush-top carbon. In the case of cells having an extended carbon, the binding-post at the side of this is passed through the vertical slot directly below the lamp casing. The outfit can be attached to a cell in a few moments, and when secured thereto forms a strong electrical and mechanical connection to the cell, so that the entire outfit can be swung around by the handle without danger of detachment.

This equipment was designed primarily for service and therefore embellishments were eliminated and the outfit reduced to its simplest form. The lamp casing includes an efficient reflector and a powerful lens, both of which combine to concentrate the beam of light for illuminating objects at a considerable distance. The switch controlling the lamp is conveniently arranged close to the handle. The simplicity of this equipment permits it to be put out at an exceptionally low price. When used in continuous service, the outfit will give about 25 hours of steady light, and from 40 to 50 hours when used intermittently. The parts of the outfit are made of brass nickel-plated. This outfit is made by the Manhattan Electrical Supply Company, 17 Park Place, New York City. This company has organized an active publicity campaign for pushing this type of lantern in the interest of the "Safety First" movement.

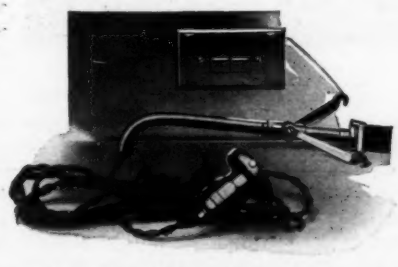


Redsealite Portable Lantern Outfit Ready for Attachment to Dry Cell.

Redsealite Lantern Ready for Use.

Brackets for Hotel Sample-Room Lighting.

An important feature in every hotel catering to commercial patronage is the series of sample rooms arranged for the display of goods by traveling salesmen. These patrons usually pay a liberal amount for the use of the rooms and wish them to be as attractive, bright and neatly arranged as possible. The hotel management, on the other hand, frequently has to arrange these rooms for regular guests. Objection has frequently been made by the latter to the variety of equipment occasionally left in these rooms and which immediately discloses their usual character as sample rooms.



Parts of the Bryant Hotel Bracket and Special Wall Receptacle.

For meeting the situation as regards effective lighting of such rooms, a type of hotel bracket and outlet has been placed on the market by Bryant Electric Company, Bridgeport, Conn. This equipment includes a wall receptacle with disappearing doors and a wall bracket. Most commonly these receptacles are provided in the picture molding about the room, being placed fairly close so that drop lamps hanging from the brackets can be adjusted over the display tables beneath them. The bracket itself is held by two hooks, fastening them to small eyelets in the upper edge of the wall plate; this keeps the bracket horizontal and gives a neat appearance to the equipment. These receptacles can also be mounted at convenient places in the wall, so that they may come over the head of a bed. A bracket attached to the receptacle then makes a very convenient reading lamp for those who desire to read after retiring. The wall receptacles, although inconspicuous, can be covered up completely by replaceable sections of the picture molding, if it is desired to remove the last evidence of the use of the room for other than guest purposes.

Hotel Bracket Attached to Receptacle.

Committee to Consider Water Power.

The Public Lands Committee of the United States Senate has invited the American Institute of Electrical Engineers to have representatives present at the hearings on the Ferris bill, relating to the development of water power.

The New Toll Switchboard for Tampa.

The Peninsular Telephone Company has placed an order with the Western Electric Company for a complete toll switchboard equipment to be used in the new central-office building now in the course of erection in the business section of Tampa, Fla. The toll equipment is to be arranged for operating in connection with the automatic city or local lines, and is to consist of a toll switchboard, chief operator's desk, information desk, and the necessary frame and rack.

The toll switchboard is to be made up of three five-panel two-position sections finished in mission style. Of the six positions, the first will be the recording position, the second, the pay-station position, and the third, fourth and fifth the terminating toll and rural positions. The sixth position will be blank. The capacity of the present equipment will be 100 pay-station lines, 60 toll lines, 40 rural lines, 30 recording trunks and 10 interposition trunks.

Magneto, rural and toll-line circuits will be of the ring-up locking-relay type arranged with multiple and answering jacks. The pay-station line circuits will be of the central-battery type arranged to operate with regular central-battery telephones and are to be multipled throughout the switchboard. Two types of cord circuits, universal and toll, will be supplied. The universal cord circuits will be arranged with double lamp supervision, and will automatically adapt themselves to the lines with which they are used without any need of discrimination on the part of the operator. The through toll-cord circuits are to be of the high-efficiency type with lamp supervision and specially designed for magneto to toll connections.

A special feature of the equipment will be found in the service trunks which are to be arranged for completing connections from toll or rural lines direct to local subscribers. Talking pairs between the toll board and the subscribers are provided by means of special connectors. This will have the effect of speeding up the toll service, as it eliminates the necessity for putting the incoming toll calls through the local switchboard. It will also reduce the cost of operation per line per day, an important factor in telephone management. In addition to this feature, a multiple of the lines of certain heavy toll users will be carried through the toll board. No special connectors are required, however, as it will be unnecessary for the toll operator to select the line desired, the circuit being permanently connected to the proper line. She need only plug into the proper jack and ring direct with her ringing keys.

Overflow lines are also provided so that connections can be made to local subscribers through the regular automatic apparatus in case of a sudden rush of business, too great to be handled in the regular way.

A two-position chief operator's desk and a two-position information desk are to be provided for use in connection with the toll-switchboard equipment. The intermediate distributing frame and the relay rack will both be of the unit floor type, and so designed that additions may be readily made when desired.

It is planned to cut the new equipment into service in the spring of 1915. The new equipment will give Tampa, and in fact the entire district covered by the Peninsular Telephone Company, the best kind of toll service that can be supplied.

Toll Switchboard at Tampa.

Electric Fans Used in Fighting Fire.

The novel use of electric fans by a fire department in putting out a blaze is reported by the *Scientific American*. In Boston, Mass., not long ago a fire broke out in the basement of a building occupied by a wholesale paint and chemical firm. The fumes and smoke became so thick that it was impossible for the firemen to enter the basement. A half dozen of the ordinary 16-inch electric fans were quickly requisitioned by the fire chief and their breeze directed down the stairway. As soon as the rear basement windows were broken to allow the escape of the smoke and fumes, the effect of the fans gradually cleared the basement, so that the firemen could work quickly and effectively in extinguishing the flames.

Rear of Switchboard.

New Automatic Solenoid Brake.

A new automatic solenoid brake for crane, hoist, lift-bridge and similar service has recently been developed and placed on the market by the General Electric Company, Schenectady, N. Y. Exceptionally sturdy and reliable construction has been made inherent in the design on account of the severe character of the work demanded of the brake, and it is built in a complete line of standard sizes for both alternating-current and direct-current application.

All the sizes are so designed that they may be mounted on the floor even though ordered and shipped attached to the motor. In the larger sizes mounted on the motor (50 horsepower and above) the two base bars that support the brake are bolted to brackets, the latter being bolted to bosses cast on the motor frame. The two plate yokes that support each shoe are hinged at the lower end to the base bars and act as levers for applying the necessary pressure to the shoes to make the braking effective.

The force that operates the brake is transmitted to the free or top ends of the yokes through horizontal levers, which are attached to the movable element of the solenoid by means of links. When the solenoid is energized, the movable element is forced up to the end of its travel, releasing the brake. When the coil is demagnetized, the brake is set by gravity.

In the sizes below 50 horsepower, the brake has a box type of frame, which is attached to bosses on the motor frame. Cast yokes are employed in this type, but in other respects the brake is similar to that for motors having capacities of 50 horsepower and above. All these designs may be modified to suit the requirements of such special applications as lift bridges, printing presses, etc.

The brake has three unique features: automatic solenoid air-gap adjuster, automatic shoe-clearance adjuster, and floating top core type of solenoid.

The solenoid air-gap adjuster is designed to maintain constant the distance between the upper, or floating, and the lower cores of the solenoid when the brake is on. This adjustment is made by means of a ratchet wheel, pawl and adjustment rod shown in the illustration, which represents the type of brake designed for motors of capacities 50 horsepower and above. The pawl is so designed that when the air gap in the solenoid—i.e., the distance between the upper and lower cores—increases beyond a certain value, the pawl will engage with a tooth of the

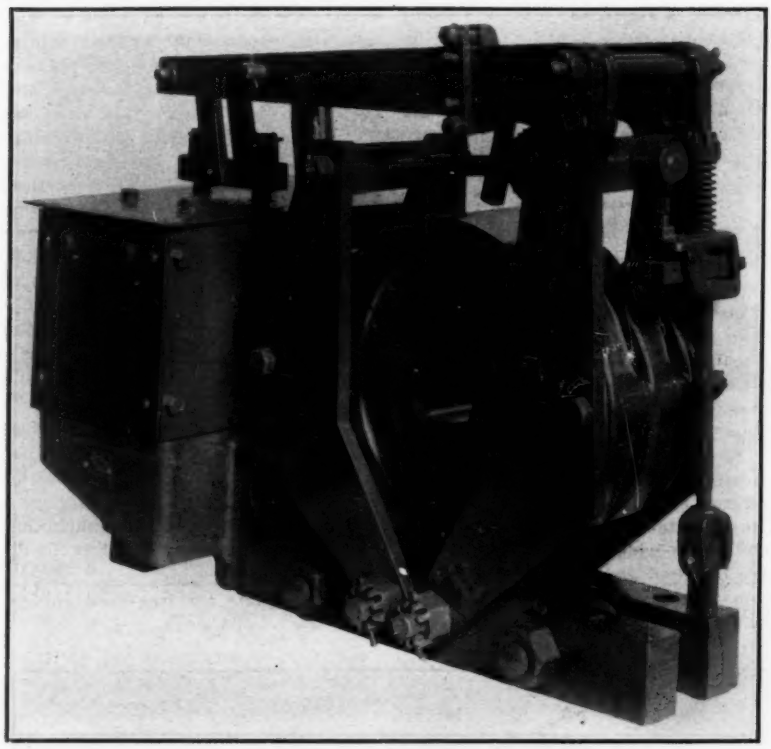
ratchet wheel and rotate it slightly when the movable element of the solenoid is forced up by the magnetic field of the latter to release the brake. This shortens the air-gap in the solenoid slightly, with the result that the movable element does not drop far enough when the brake is set for the pawl to engage the ratchet wheel again until the shoes wear sufficiently to permit it. One tooth on the ratchet wheel corresponds to a slight variation in the distance between the upper and lower solenoid cores, so the adjustment is very close.

In the shoe-clearance adjuster, a rod attached to one of the base bars passes through a bracket bolted to one of the yokes. This bracket has a slot for a spring clamp attached to the rod. As the shoes wear, allowing the yokes to approach slightly nearer to the wheel when the brake is set, the spring clamp is moved up correspondingly by the bracket, these two parts being in contact when the brake is on. As soon as the brake is released, the right-hand yokes move back under the influence of gravity and the spring until the set-screw strikes the spring clamp. This, the distance between these two positions of the shoes—i.e., the shoe clearance—is maintained constant.

The braking effect may be increased by changing the lever pin to one of the other sets of holes designed for it, and also by removing one or more of the weights on the movable element of the solenoid.

An oil dashpot, single-acting in the downward direction, is supplied with the larger sizes to prevent any rebound of the movable element of the solenoid at the instant of setting the brake, thus giving a smooth application. The dashpot effect may be varied, but all dashpots are correctly adjusted at the factory, using an oil that is little affected by changes in temperature.

The solenoids supplied with these brakes are inclosed in a ventilated, but rainproof casing, and provided with a floating top core. When the movable element, as it reaches the upper limit of its travel, strikes the floating top core, the latter, being held in place by magnetism only, yields slightly preventing a severe blow being struck. Since, in ordinary service, solenoids operate several times per minute, it is readily seen that this is a great gain, as it materially adds to the life of the coil and other parts and also insures smoother operation.



Automatic Solenoid Brake.

With respect to direct-current brakes, a series-wound coil is standard for crane work. All standard series brakes release on 40 per cent of rated full-load current of the motor to adapt them to dymanic braking. There are special applications which require a shunt winding, as, for instance, bridges where the motor coasts with the current off and brake released.

Alternating-current solenoids are shunt-connected. Coils for such high potentials as 2,200 volts can be furnished, if desired, for standard frequencies ranging from 25 to 60 cycles. These are single-phase and therefore suitable for single, two and three-phase circuits without change. Pole-shading rings are inserted in the face of the solenoid core at the air-gap surface in order to insure practically noiseless operation.

Brakes are rated in pounds retarding torque at one-foot radius on the brake-wheel shaft, the term "retarding torque" being applied to the torque when the armature of the motor is rotating. When the armature stops rotating, the "holding torque at rest" of the brake increases considerably. This is due to the fact that the coefficient of friction when the wheel is at rest is greater than when it is rotating. All brakes have a maximum retarding torque of not less than the full-load torque of the motors on which they are used.

The design of the solenoid coil shoes, and other parts is such as to permit ready removal. All wheels are cast steel, as this metal gives maximum strength with minimum weight. They are perfectly balanced, and those for the mill type of motors and alternating-current crane and hoist motors are taper-bored to facilitate removal of the wheel. All wheels are of small diameter so as to have small flywheel effect, and of wide face to insure ample wearing surface. The brake is so designed that the wheel cannot drop off even though it may accidentally work loose.

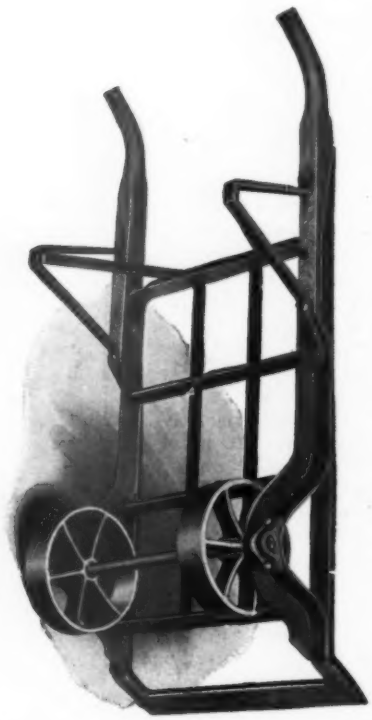
The solenoid coil is connected to the controller so that when the latter is thrown to the "on" position, the movable element of the solenoid is raised, thereby releasing the brake and allowing the motor armature to revolve freely.

When the controller is thrown to the "off" position, or when the power fails, the movable element drops, this causing the brake to set and hold the motor armature from turning. In special cases, as, for instance, in the service on a lift bridge, where the brake and motor turn through an angle, the brake is set by means of a spring, which assures constant braking at all angles.

Edwards Steel Trucks.

In electrical manufacturing, warehousing, and merchandising, heavy boxes and barrels must frequently be moved, for which purpose a handy form of strong truck is essential. As the result of an experience of over 30 years in the manufacture of iron and steel products, the Edwards Manufacturing Company, Cincinnati, O., has placed on the market a line of steel

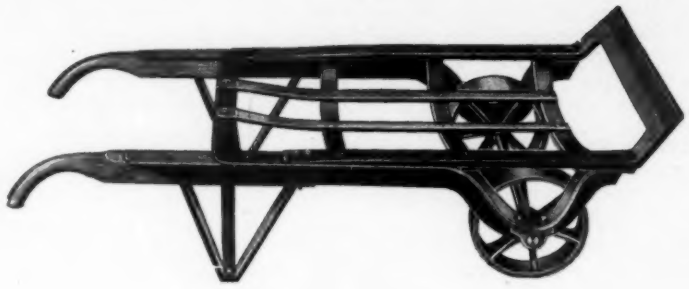
trucks designed particularly for great endurance in severe service. In the design of these trucks wood was eliminated entirely, except for the handles. In the view of the bottom of one of the trucks it will be observed that the body is composed of a U-shaped angle steel, which is provided with dips for supporting the axle and bearings. This angle bar is two and one-half inches deep and three-sixteenths inch thick. It serves as the backbone of the truck. The cross ribs joining the two sides are made of T steel, one and one-half inches by one and one-half inches by three-sixteenths inch thick. The upper surface of the truck is reinforced by strong steel plates. All parts of these



Underside of Edwards Steel Truck, Showing Strong Construction.

trucks are riveted, except where the axle bearings are attached to the angle bar and where the replaceable handles are connected to the side bars. The handles are reinforced with angle steel, and in case of an accident can be replaced in a few minutes. The handles are made of straight-grained timber bent under steam pressure. They have a natural finish. All steel parts of the truck are painted black.

An interesting feature of these trucks is that the wheels are within the body line of the truck, which permits free passage through narrow aisles and avoids collision with obstacles. In the barrel truck shown in the second illustration, the T-steel cross bars are curved so as to fit the shape of a barrel. The slats on the working surface are also curved. The wheels are eleven inches in diameter and have two and three-fourths inch tread. The nose of the truck is six inches long, the width of the entire truck is 24 inches, and its over-all length is 62 inches. Its total weight is approximately 120 pounds. The manufacturers believe that these trucks are made as nearly indestructible as equipment of this kind can be built.



Edwards Barrel Truck.

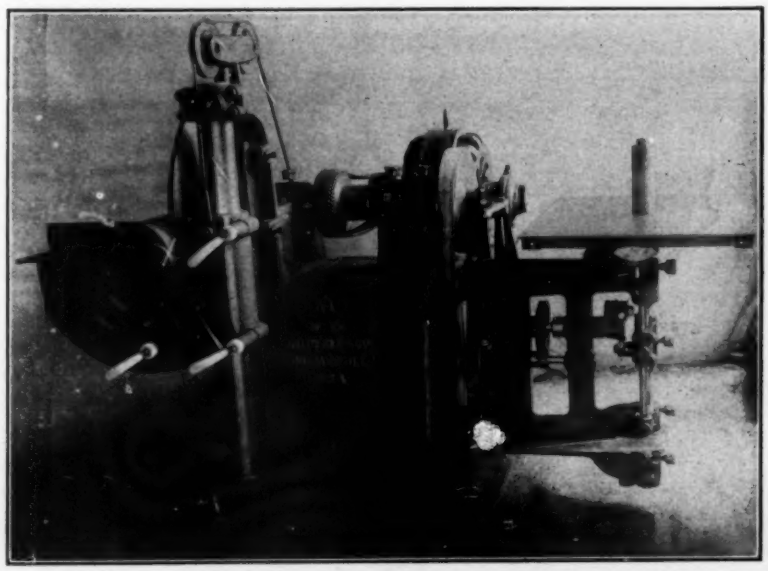
Combination Disk Grinder and Drum Sander for Wood Pattern-making.

The illustration herewith shows a motor-driven pattern-makers' disk grinder manufactured by Charles H. Besley & Company, Chicago, all gear guards being removed to show the construction.

The disk wheel is of steel, 30 inches diameter by three-quarter inch thick, and runs at 750 revolutions per minute. The work table serving the disk wheel is 14 inches wide by 40 inches long. It may be tilted and locked at any angle from 75 degrees to 135 degrees from the plane of the grinding disk large distinct graduations being provided to govern this angular adjustment. The construction is such that the inside of the working edge of the table remains within one-thirty-second inch of the disk, regardless of the angular adjustment, and the supporting mechanism is at the back of the disk wheel and below the face of the work table, so that the top of table is always clear of obstructions from one end to the other. The work table has a vertical adjustment of 25 inches and, being supported by a round vertical shaft, it may be swung away from the grinding disk for convenience in resetting the wheel or facing off extra large patterns.

The machine is equipped with four work-table attachments, which are very valuable on wood pattern work, as follows:

(1) Sizing circle gauge, for cylindrical and conical grinding.
(2) Sliding bevel gauge, for simple and compound angle grinding.
(3) Sizing bevel gauge, for simple and compound angle grinding to dimensions.
(4) Angle plate for free-hand cornering of thin work.



Motor-Driven Disk Grinder and Drum Sander.

The drive is furnished by a three-horsepower Westinghouse induction motor running at 1,140 revolutions per minute.

New Electric Cook Stove.

Simplicity, ruggedness and efficiency were the characteristics aimed at in the design of a new three-burner electric stove that is to be put on the market early in 1915. As shown in the illustration herewith, this stove has very simple yet not unattractive lines. This makes it very easy to keep clean and bright. Every part of the outfit is well built of high-grade material.

S. P. Electric Cook Stove.

Each of the burners has a heating unit arranged for three heats with a maximum of 770 watts each. The maximum load with all burners at high heat is 2,310 watts. A three-heat snap switch controls each burner. The burners are guaranteed for two years, and in normal service are expected to last five or more years. The stove can be wired to a 110-volt two-wire and 220-110-volt three-wire circuit.

A convenient shelf is placed beneath the burner level for placing dishes and kettles so as to be handy for cooking. Dimensions of the stove are 30 inches high, 31 inches long and 14 inches deep. A portable oven is provided for baking; this can be placed over two burners, leaving the third for other use. The manufacturer states that this stove can do everything in the cooking and baking line that any flame stove can do in practically the same length of time. With electric current at five cents per kilowatt-hour, the stove operates cheaper than a gas range with gas at $1.25 per thousand cubic feet. On account of the simplicity of construction of the stove its retail price will be low.

This stove has been developed by Sebring Phelps and is being marketed by the S.-P. Stove Company, Wilmette, Ill.

New Electrically Driven Silver-Burnishing Machine.

The machine illustrated consists of a wooden cylinder which is three-quarters filled with smooth, highly polished steel balls, varying in size from about one-fourth inch in diameter to about the size of a very small pin head. In addition there are also a number of smooth, blunt slugs. Steel plates divide the cylinder into several compartments for different classes of silverware.

Motor-Driven Silver-Burnishing Machine.

These machines are made in varying sizes, and are driven by one-eighth to two horsepower motors, made by the Robbins & Myers Company, Springfield, O.

To operate the outfit, the silver is placed in the cylinder with the steel balls, and is covered with hot soap suds. The current is then turned on and the machine is allowed to operate for about ten minutes. By centrifugal force the pieces of silver are moved to the center, and the steel balls roll over and around them, while the steel slugs penetrate fretwork and crevices that even the smallest ball may not enter. The silver is cleaned, burnished and sterilized.

In addition to saving time and labor, it is claimed that this machine will burnish the most inaccessible places which cannot be reached by hand, and that it also removes the disagreeable odors which are so difficult to remove from silverware which has seen some months of hotel service.

The machine has recently been placed on the market by the Tahara Company, of America, Glenwood Avenue and Second Street, Philadelphia, Pa.

Rapid Reconstruction of Telephone Lines After First Destructive Storm of the Winter.

Two days, December 7 and 8, of sleet, rain, cold high winds and falling trees resulted in 25,000 miles of fallen wire and 1,200 poles down on the toll and local lines of the Southern New England Telephone Company. By prompt and effective emergency shipments of material for making temporary repairs from the Western Electric Company's warehouse at West Haven, Conn., it was possible to re-establish toll lines to every exchange in the state by the evening of December 10.

In the 72 hours that elapsed between 7 p. m. December 7 and the same time December 10, there were shipped over 1,000,000 feet of twisted-pair copper-steel distributing wire, 93,000 pounds of bare copper wire, 19,000 pounds of iron wire, over a ton of copper tie wire and 26,000 sleeves, as well as a great quantity of other line-construction material. The total bulk shipped during this period weighed over 109 tons and was moved in six special trolley freight carloads, three special freight cars and numerous express shipments.

The various transportation companies by co-operating with the shippers in every possible way aided greatly in the rapid restoration of telephone service.

Latest Approved Fittings

The electrical fittings illustrated and described in this department have been approved by the Underwriters' Laboratories, Incorporated, following examination and tests conducted under standards of the National Electrical Code as recommended by the National Fire Protection Association.

ATTACHMENT PLUGS, Fuseless.—The Bryant Electric Company, Bridgeport, Conn.

"Bryant" or "Perkins".

1 ampere, 250 volts, 3 amperes, 125 volts, catalog Nos. AV-23, AV-24.

Approved December 1, 1914.

CABINETS,—D. & W. Fuse Company, Providence, R. I.

"D. & W." branch boxes, each consisting of cast-iron box containing porcelain base with three main-line terminals and single-branch connection having three-pole cutout base for National Electrical Code standard cartridge-inclosed fuses. 0-30, 31-60 and 61-100 amperes, 250 volts, catalog Nos. 1950, 1951, 1952.

Approved December 1, 1914.

CONDUIT BOXES.—Steel City Electric Company, 1207 Columbus Avenue, Pittsburgh, Pa.

Pressed-steel boxes. Catalog Nos. BUL ½ BUL ¾, BUW ½, BUW ¾, BY 1½, BY 2, BY 2½, BY 3, 5G, 6G, 7G, 8G, 9G, 2G, 3G, 4G.

"Campbell" cast-iron boxes; types A, B, C, D, E.

Also the above types with covers.

Approved October 20, 1914.

CONDUIT OUTLET PLATES.—Chicago Fuse Manufacturing Company, 1014 West Congress Street, Chicago, Ill.

"Union" pressed-steel outlet plate, catalog No. 114.

Approved November 18, 1914.

CURRENT TAPS.—Benjamin Electric Manufacturing Company, 128 South Sangamon Street, Chicago, Ill.

"Benjamin" 660 watts, 250 volts.

Combinations of Edison shell attachment plug and medium-base socket or lamp cluster and, in socket form, having special attachment plug at side of device.

Key, lever type, multiple, catalog Nos. 96, 496-499 inclusive; series, catalog Nos. 96½, 496½-499½ inclusive.

Keyless, multiple, catalog Nos. 93, 94; series, catalog Nos. 93B, 94B, 95½.

Special attachment plug for use with above current taps, catalog No. 97.

Approved December 1, 1914.

CURRENT TAPS.—The Bryant Electric Company, Bridgeport, Conn.

"Bryant" or "Perkins".

This device consists of combination of twin brass-shell socket and swiveling Edison-type attachment plug.

Pull, 250 watts, 250 volts, catalog No. AV-17.

Approved November 27, 1914.

FASTENERS. — Metal Specialties Company, 710 R. A. Long Building, Kansas City, Mo.

McKinley No. 7. Fasteners for securing quarter-inch trade-size flexible tubing in switch and outlet boxes having five-eighth-inch-diameter knockout holes. Each consists of coppered-steel collar formed to engage edge of knockout hole in boxes and has sharp projections to grip tubing.

Approved November 27, 1914.

FIXTURES.—Benjamin Electric Manufacturing Company, 120 South Sangamon Street, Chicago, Ill.

"Benjamin" reflector fixtures for use with type C, nitrogen-filled lamps. Catalog Nos. 1010, 1012-1017 inclusive, 5551, 5555, 5557, 5559, 6100-6104 inclusive, 6106-6109 inclusive, 6111-6114 inclusive, 6116-6119 inclusive, 6121-6124 inclusive, 6126-6129 inclusive, 6153-6158 inclusive, 6176-6179 inclusive, 6271-6274 inclusive.

Standard only when wired with wire having approved slow-burning insulation, or, in case of chain pendants, with approved flexible cord for electric heaters.

Approved November 20, 1914.

FIXTURES.—Shapiro & Aronson, 20 Warren Street, New York, N. Y.

Standard electric and combination fixtures.

Commercial products of this class which are regularly examined and tested under the supervision of Underwriters' Laboratories at factories where they are produced bear uniform labels.

Approved November 19, 1914.

LAMP ADJUSTER.—The Gowan Electric Adjuster Manufacturing Company, 388 George Street, Toronto, Can.

Type "A" cord adjuster.

Adjuster for pendent lamps, consisting of spring-controlled porcelain drum, to which ends of portable cord are attached and connected in circuit through insulated supports on opposite sides of drum. An insulated brass shell incloses operating parts and is provided with insulating bushing at lower end through which cord passes.

Approved November 30, 1914.

RECEPTACLES, For Attachment Plugs.—The Bryant Electric Company, Bridgeport, Conn.

"Bryant" or "Perkins".

Flush type.

Disappearing door type, 10 amperes, 250 volts, catalog No. 430; plate for same catalog No. 431.

Removable-mechanism type, 20 amperes, 250 volts, consisting of removable-mechanism switch base, removable receptacle and plug catalog Nos. 2520 base; 2528 receptacle; 2567 plug.

Approved December 1, 1914.

RECEPTACLES, Standard.—General Electric Company, Schenectady, N. Y.

"G. E." porcelain-shell.

Key, 250 watts, 250 volts, catalog No. GE094.

Keyless, 660 watts, 250 volts, catalog Nos. GE088, GE095. GE512, GE513.

Approved December 1, 1914.

RECEPTACLES, Weatherproof. — General Electric Company, Schenectady, N. Y.

"G. E." 660 watt, 250 volts, catalog Nos. 9411, 25706, 25707, GE089, GE096, GE427, GE428.

Approved December 2, 1914.

SIGNAL APPLIANCES.—Schwarze Electric Company, Adrian, Mich.

"Schwarze" electric bells.

Universal No. 3; double-gong magneto; single-gong magneto, catalog No. 21; single-stroke, catalog No. 14.

Approved November 13, 1914.

SOCKET LININGS.—C. L. Sherman, 5142 Master Street, Philadelphia, Pa.

"Fibreo" socket linings.

These linings are found generally satisfactory for use in sockets and receptacles under specifications of rule 72*d* of the National Electrical Code.

Approved September 1, 1914.

SOCKET LININGS.—The Elastoid Fibre Company, Waltham, Mass.

"Elastoid" socket linings, soft and hard styles.

These linings are found generally satisfactory for use in sockets and receptacles under specifications of rule 72*d* of the National Electrical Code.

Approved September 1, 1914.

SWITCH BOXES.—Adapti Manufacturing Company, 1661 Leonard Street, Cleveland, O.

Pressed-steel boxes in single units for use with flexible tubing or rigid conduit. These boxes have removable sides and suitable fastenings by means of which a gang box of any desired number of units can be obtained.

Approved November 17, 1914.

SWITCHES, Push-Button Flush.—The Bryant Electric Company, Bridgeport, Conn.

"Bryant" or "Perkins".

Combination switch and pilot lamps, 10 amperes, 125 volts, catalog No. 495.

Approved November 27, 1914.

Current Electrical News

ATLANTIC STATES.

LEWISTON, ME.—The Lewiston & Auburn Electric Light Company, and the Portland-Lewiston Interurban Railroad have been sold to the Androscoggin Electric Company.

LYNN, MASS.—Citizens of the Highland district have petitioned the Municipal Council for the installation of electric lights on Beacon Hill extension and on Adams Street between Highland Avenue and Rockaway Street. W.

ALLENTOWN, PA.—Proposals will shortly be invited for the electrical equipment in the new $500,000 high school building in this city, foundations of which are nearly completed. Ruhe & Lange, of Allentown are the architects in charge, and J. M. Wuchter is president of the Board of Education.

ALLENTOWN, PA. — Work has been started here on the construction of a new armory building to cost about $50,000. A modern electric lighting system will be installed. Mennough & Son of York, Pa., are the general contractors for the State Armory Board.

EASTON, PA.—The Hart Chemical Corporation has been formed and next spring will start the erection of a large plant here for the manufacture of potash and a line of chemicals similar to those until recently imported into this country from Germany. It is said that electrical machinery will be used to a large extent in the various processes. Dr. Edward Hart, professor of chemistry at Lafayette College, is president, and Gilbert Dannehower is mechanical engineer of the new concern.

KUTZTOWN, PA.—Borough council has voted to erect a new power plant for furnishing light and power for commercial and municipal purposes, at a cost of $23,000, which was voted at the November elections. The Allentown & Reading Traction Company and the Lehigh Navigation Electric Company bid for the privilege, but the decision noted above was finally made. The present plant will be operated until the new plant is erected. F. A. Moyer is chairman of the Electric Light Committee.

SOUTH ALLENTOWN, PA.—An ordinance has been passed by councils authorizing the borough officers to enter into a contract with the Lehigh Valley Light and Power Company to light the borough streets for a period of five years. A. H. S. Cantlin is general manager of the company, with headquarters in Allentown.

FAIRMONT, W. VA.—The Monongahela Valley Traction Company is just completing a $350,000 power plant, which will be used as an auxiliary to the steam plant which has been furnishing the company power to operate its lines. The auxiliary plant is located at Hutchinson, almost midway between Clarksburg and Fairmont.

NORTH CENTRAL STATES.

BUCYRUS, O.—The Bucyrus Electric Light & Power Company is planning to double the capacity of its plant. Address A. G. Moser, superintendent.

CINCINNATI, O.—Charles Behlen & Sons, manufacturers of and dealers in electric automobiles, will construct an additional service station at their plant, intended for the use of electric machines under their charge. Zettel & Rapp are preparing the designs.

DAYTON, O.—A petition has been circulated among the property owners for boulevard lights to be installed on Wilkinson, Second, Ludlow, First and Jefferson Streets. If the property owners will pay for the maintenance of these lights the city is willing to do its part of the work. L.

GALLIPOLIS, O.—The electrification of a large mining operation and the possible construction of a hydroelectric plant on the Ohio River, to develop 3,000 horsepower, are among the plans of the newly organized Indian Guyan Coal Company, of Cleveland, O., controlling over 2,000 acres of coal lands near here. About $15,000 will be spent on the electrical and other equipment for the mines. S. L. Fedder, who is now at Gallipolis supervising the work, is general manager. L.

GREENCASTLE, IND. — The Greencastle Electrical Company has taken over the business recently inaugurated by Niles Couchman and Clifford Couchman, who have formed a partnership with Clarence Hazelett. The Greencastle Company will handle a complete line of electrical supplies and specialize on repair work. G.

MARENGO, IND. — The new electric light plant will soon be supplying service, according to G. W. Churchill, the manager, who reports that the equipment is being rapidly installed and will soon be put in operation. G.

ELGIN, ILL.—The question of issuing $125,000 electric light bonds will be submitted to the voters in the spring. Address city clerk.

MT. MORRIS, MICH.—The proposition of granting the Flint Electric Company, a franchise to furnish electricity for power and light for Mt. Morris has carried.

SAGINAW, MICH.—A petition has been started to have the council provide a special election on February 23, to vote on a bond issue of $750,000 for an electric light plant and distribution system.

BLACK CREEK, WIS.—A $7,000 municipal electric plant will be established here. Address town clerk.

MAPLETON, MINN.—Stock subscriptions to the amount of $10,000 have been raised by citizens of this village, and the organization of a company is under way to purchase the local lighting plant. X.

ST. PAUL, MINN.—H. W. Terry, consulting electrical engineer of the A. H. Stem Company, St. Paul, will have charge of the electrical work on the new St. Paul Athletic Club building, which is to cost over a half million dollars. The A. H. Stem Company has been chosen as the architect of the new club house. X.

WINDON, MINN.—The council is planning ways and means to install a municipal lighting plant. Address village clerk.

COLLINS, IOWA.—The Maxwell Electric Light and Power Company has petitioned the council for a franchise to furnish electric lighting. Address village clerk.

RUSSELL, IOWA.—The electric light proposition has been carried and a franchise was granted to Edward B. Perrigo to supply 24-hour service from the Chariton plant. Work will be commenced on the transmission line at once.

MADISON, S. D.—The city council has decided to make extensive improvements to the municipal electric light system. A new engine and dynamo will be installed. The improvements will cost about $20,000, of which $15,000 already is in the electric light fund.

CONCORDIA, KANS.—The Concordia Electric Light Company is building lines for furnishing service to 14 farm houses and the Ada Lutheran church, the patrons to pay for the building of the lines. Similar installations will be made between Concordia and Courtland as soon as the company can do the work. M.

KANSAS CITY, KANS.—Bids will soon be called for on wires, motors, heaters, etc., needed in connection with a municipal electric light plant. A three-mile, 660-volt line is to be erected soon. Address city electrician.

LARNED, KANS.—Bids will be asked at once for constructing a $90,000 light and water system. Address town clerk.

SOUTH CENTRAL STATES.

LOUISVILLE, KY.—Bids on electric light installations for all of the Louisville public parks and drivewav systems have been asked for by the Board of Park Commissioners. This will mean 273 lamps. The request was made for bids following receipt of bids on 163 lights, quoting the installation price at $39 a light. G.

DENISON, TEX.—The Denison Cotton Mills will invest about $30,000 for a new power plant and some textile manufacturing machinery. All contracts for this new equipment and for installation have been awarded, and the work is to be completed some time during this month.

HOUSTON, TEX.—The Colorado River Power Company, of Marble Falls, plans to build an electric power transmission line from Marble Falls to Houston.

WESTERN STATES.

GREEN RIVER, UTAH. — The Green River irrigation district, of which S. J. Meer is city clerk, will receive bids until January 4, 1915, on bare and insulated copper, insulators, pins, cross arms, and other line material for seven miles of transmission and distribution lines for the electric light system to be installed here. Also, for the manufacture, delivery, and erection of hydraulic and electrical apparatus to be installed in the power house of the Green River irrigation district, and on 275 30 to 35-foot cedar poles. Plans and specifications for this material may be obtained from the city clerk. U.

TOOELE, UTAH. — The Clark Electric Power Company has entered into a contract with the Utah Light and Power Company to purchase its requirements of electric power on a wholesale contract from the latter company. The local electric company has been taking about 200 horsepower under this contract since December 1, and is now in a position to give first class service to its customers. Superintendent Anderson, of the Clark Electric Company has instituted a number of innovations to encourage the installation of meters and the use of continuous current, which will not only result in benefit to the company's patrons, but also in an economy of power for the company. U.

WHITE OAKS, N. M.—The Wild Cat Leasing Company is constructing a new electric power plant near here, supplemental to its existing one. A total of 1,100 horsepower will be available. The company is extending its power transmission system to the properties of the Parsons Mining Company and the American Mining Company. D.

DOWNEY, IDAHO.—The installation of a street lighting system, work to begin shortly after the first of the year, is contemplated by the City Council. For additional information address the mayor or city clerk. O.

SODA SPRINGS, IDAHO.—A special election to vote a bond issue of $15,000 for the installation of a municipal lighting plant, will be held in this city on December 28. For further information address the chairman of the Town Board, J. F. Woodall. O.

EVERETT, WASH.—The Jim Creek Water & Power Company, Arlington, Wash., of which E. G. Robinson, Jr., is manager, has been granted a franchise by the Snohomish County Commissioners to lay pipes and erect electric transmission wires along county roads in certain portions of Snohomish County. The company intends making extensions and improvements immediately. O.

SPOKANE, WASH.—Bids for furnishing and installing forty additional arc lamps in this city will shortly be received by the city clerk here. O.

TACOMA, WASH.—George C. Bratt, H. A. Frauens and Samuel Cassimer, all of Tacoma, recently filed articles of incorporation with the county auditor of Pierce County, for the Molander-Hawaiian Power Company. Tacoma is named as the principal place of business and the company is capitalized at $250,000. According to all accounts the new incorporation will generate and sell electric current in Tacoma and vicinity. O.

TACOMA, WASH.—The city council has ordered the installation of a system of lights on C and other streets, according to specifications prepared by the city engineer. These are to consist of metal standards with a single globe on each. The cost is estimated at $17,-241.

LONG BEACH, CAL.—The city council has passed an ordinance ordering the installation of ornamental cast iron lamp posts, equipped for use along both sides of the principal business streets.

LONG BEACH, CAL.—The city council has passed an ordinance providing that all electric wires be placed underground in this city. Work on the proposed improvement is to begin not later than July 1, 1915, and be completed by the end of the year.

SAN DIEGO CAL.—The Escondido Mutual Water Company has applied for a franchise to install an electric transmission line from its power plant on the San Luis Rey River to its power plant below the reservoir, thence through Rincon, San Marcus and San Pasqual valleys to Escondido. The county board of supervisors has the petition under consideration.

SAN DIEGO, CAL.—The city council has ordered the city engineer to prepare plans for a new system of street illumination during exposition year. Plans will call for a system of electric arches in the principal business streets.

PROPOSALS.

LIGHTING FIXTURES.—Sealed proposals will be received at the Supervising Architect's Office, Treasury Department, Washington, D. C., until January 26, 1915, for lighting fixtures for the United States post office and courthouse at McCook, Neb. Drawings and specifications may be obtained from the custodian of site at McCook, or at the office of the supervising architect.

LIGHTING FIXTURES.—Sealed proposals will be received at the office of the Supervising Architect, Treasury Department, Washington, D. C., until February 8, 1915, for lighting fixtures for the United States post office at Tiffin, O. Drawings and specifications may be obtained, after January 1, from the custodian at Tiffin, or at the office of the supervising architect.

ELECTRIC SYSTEM.—Sealed proposals, indorsed "Proposals for Power Circuit," will be received at the bureau of yards and docks, Navy Department, Washington, D. C., until January 2, 1915, for an extension to the underground electric distribution system at the naval training station, Great Lakes, Ill. Plans and specifications may be obtained on application to the bureau or to the commandant of the naval station named. H. R. Stanford, chief of bureau.

ELECTRICAL EQUIPMENT, NAVY DEPARTMENT.—Sealed proposals will be received by the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., until January 5, 1915, for furnishing the following electrical equipment: 150 watertight bells and 12 watertight buzzers, as per Schedule 7708, for delivery at Navy Yard, Norfolk, Va.; 500 feet telephone cable, as per schedule 7708, for delivery at Navy Yard, Brooklyn, N. Y.; miscellaneous magnet, cotton and silk-covered wire, as per Schedule 7708, for delivery at Navy Yard, Philadelphia, Pa.; miscellaneous magnet, single cotton-covered wire, as per Schedule 7708, for delivery at Navy Yard, Charleston, S. C.

ELECTRICAL EQUIPMENT, NAVY DEPARTMENT.—Sealed proposals will be received by the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., until January 12, 1915, for furnishing the following electrical equipment: 1,700 feet of interior communication cable, as per Schedule 7728, for delivery at Navy Yard, Norfolk, Va.; 5,-000 feet flexible cord for portable, as per Schedule 7735, for delivery at Navy Yard, Philadelphia, Pa.; 2,650 feet lighting and power wire, as per Schedule 7728 for delivery at Navy Yard, Norfolk, Va.; miscellaneous single conductor and rubber-covered copper wire, as per Schedule 7735, for delivery at Navy Yard, Washington, D. C.

FOREIGN TRADE OPPORTUNITIES.

[Addresses may be obtained by writing (mentioning file number) to the Bureau of Foreign and Domestic Commerce, Washington, D. C., or to the nearest of its branches at Boston, New York, Atlanta, Chicago, New Orleans, Seattle and San Francisco.]

NO. 14,804. HARDWARE, ELECTRICAL SUPPLIES, ETC.—A commission firm in Russia informs an American consular officer that it desires to establish direct relations with American manufacturers of hardware, tools, and implements, files, meat choppers, ice-cream freezers, grinders, petroleum kitchen and heating stoves, and electrical supplies and lamps. Correspondence should be in Russian, French, or German. References are given.

NO. 14,807. ELECTRICAL TRADE EXTENSION.—An American consular officer in South America reports that an electrical engineer who has had many years' experience in the markets of South America expects to be in the United States during the winter months, and will be pleased to meet American manufacturers who may wish to establish relations with Latin American countries.

NO. 14,812. ELECTRIC APPARATUS.—The manager of a municipal electric plant in Europe desires to be placed in communication with manufacturers of electrical supplies and fittings, including lamps.

NO. 14,872. ELECTRIC TRAMWAY CONSTRUCTION.—An American consular officer in Europe reports that a company in his district has filed an application for a franchise to build an electric tramway. The line is to be 31 miles in length.

NO. 14,876. ELECTRICAL SUPPLIES, ETC.—An American consular officer in Asia Minor reports that a commission house in his district desires to place orders for electrical supplies of all kinds—electric lamps, electric motors and dynamos, oil and water pumps, horizontal and vertical Diesel engines, gas pipes, and high-pressure pipes. It is explained that the firm does not require credit, and wishes to establish relations with manufacturers of the highest-class goods. Correspondence should be in Russian, German, or French, and prices should be c. i. f. destination. References are given.

NEW PUBLICATIONS.

SOUTHWESTERN ASSOCIATION.—Proceedings of the ninth annual convention of the Southwestern Electrical and Gas Association, held at Galveston, Tex., May 20-23, 1913, have been published.

COAL ANALYSIS.—Bulletin No. 76

of the Engineering Experiment Station, University of Illinois, is entitled "The Analysis of Coal with Phenol as a Solvent," by S. W. Parr and H. F. Hadley. This study mainly concerns the coking properties of coal.

FIRE INSURANCE.—The report of Rufus M. Potts, insurance superintendent of Illinois, to the governor on "Investigation of Fire Insurance Conditions and Rates in Illinois" has been issued in pamphlet form. It is an illuminating document on the history and practice of fire insurance, and shows that the present rates in Illinois are exorbitant. State insurance as well as laws regulating private companies are urged.

ELECTRICAL DEALER AND CONTRACTOR—Beginning with the November issue a monthly periodical will be published by The Commercial Press, Limited, Toronto, Canada, under the title *The Electrical Dealer and Contractor*. The aim is to assist electrical dealers in Canada to sell more appliances and to assist contractors to raise the standard of work. The subscription price $1.00 per year in Canada; $1.50 in the United States. The initial issue contains 26 pages of reading matter 9 by 12 inches.

NEW INCORPORATIONS.

STANLEY, N. D.—The Stanley Electric Company has been incorporated with a capital of $10,000, by N. G. Nelson and others.

LOS ANGELES, CAL.—The Kanaky Electric & Manufacturing Company has been incorporated with a capital stock of $25,000, by S. E. Goar, E. E. Hull and H. P. Kanaky.

NEW YORK, N. Y.—Royal Electric Motor Company, Incorporated, capital $9,000. The incorporators are Abraham Zwenitzky and Benjamin Schwartz, of Brooklyn, and Isaake Joffe, of New York.

BROOKLYN, N. Y.—Baker Electric Motor Service, Incorporated. Capital $20,000. Incorporators: Frank A. Jannicky and B. R. Shears, of Brooklyn, and Frederick Bowers, of New York.

CAMDEN, N. J.—The Clayton Electric Light Company has been incorporated with a capital of $100,000, to operate electric light plants. The incorporators are: F. R. Hansell, J. A. MacPeak, and I. C. Clow.

NEW YORK, N. Y.—Habacht & Weiss, Incorporated, to manufacture electric fixtures, wrought-iron and brass fixtures, etc. Capital $3,000. Incorporators: Harry Habacht, Max Weiss and Solomon Brinn, of New York City.

BRIDEPORT, CONN.—The A. A. Electric Manufacturing Company has been incorporated with a capital stock of $20,000, for the purpose of manufacturing and marketing electrical supplies. The incorporators are Harvey W. Chapman, Edward K. Nicholson and Paul S. Chapman. W.

STITHTON, KY.—The Stithton Lighting Company has filed articles of incorporation, chartering it to operate the electric light plant in Stithton. Capital stock $3,000. The incorporators and officers are C. H. Aubrey, president; G. H. Greenup, vice-president, and L. J. Metcalfe, secretary and treasurer.

SANTA FE, N. M.—Articles of incorporation have been filed here for the Trinidad Electric Transmission Railway & Gas Company, of Trinidad, Colo., capitalized at $4,000,000.

FINANCIAL NOTES.

The Interstate Public Utilities Corporation, of Rochester, N. Y., has purchased the controlling interest in the electric light and power properties at Kane, Ridgeway, and Johnsonburg, Pa., and will make the generating plant at Kane the central distributing station for the territory served. Current will be distributed to the three towns and also to others on the Philadelphia & Erie Railway. The company is incoroprated under the laws of Delaware, with an authorized capitalization of $2,000,000.

The protective committee of the Atlantic Gas & Electric Company is reported to be working on plans for reorganization of the company, and it is expected that when the plan is announced to the holders of Series "A" and "B" first-lien and refunding bonds practically all the bonds will have been deposited.

The Carolina Electric Company has been organized with $800,000 capital stock and $1,000,000 bonds, with an additional $1,000,000 bonds reserved for future corporate purposes. D. T. McKeithan, Darlington, S. C., has been elected president of the company, which has taken over the Florence Electric & Utility Company, the Marion Water & Light Company and the Darlington Water & Electric Company.

Directors of the Columbus Light, Heat and Power Company have called a special meeting of stockholders for January 7, at which a proposition to sell all assets, franchises and properties of the company to the Columbus Railway, Power & Light Company will be voted upon. The sale of the property has already been approved by the Ohio Public Utilities Commission and the directors. The annual meeting of the company will be held the same day.

The Wisconsin-Minnesota Light and Power Corporation, a subsidiary of the American Public Utilities Company, has been authorized to issue $367,000 preferred and $244,000 common stock. Of this amount, $300,000 preferred and $200,000 common may be issued for the purpose of acquiring the property of the Winona Gas, Light and Coke Company, the Red Wing Gas, Light and Power Company, the Minnesota-Wisconsin Power Company, the Minnesota-Wisconsin Power Corporation and the Eau Claire Gas Light Company and $17,000 to acquire all property of the Neillsville Electric Company, of Neillsville, Wis.

The Cities Service Company, which purchased control of the St. Joseph (Mo.) Railway, Light, Heat and Power Company from E. W. Clark & Company of Philadelphia, some time ago, has financed the deal through the placing of $3,194,000 of the stock in trust with the Fidelity Trust Company and issuing trust certificates against it to the extent of $1,118,000. These certificates were purchased by Philadelphia bankers.

Dividends.

	Term.	Rate.	Payable.
Am. Tel. & Tel.	Q	2 %	Jan. 15
Asheville Pr. & Lt., pf.	Q	1.75%	Jan. 2
Aurora El. & Ch., pf.	Q	1.5 %	Feb. 1
Carolina Pr. & Lt., pf.	Q	1.75%	Jan. 2
Chicago City Ry.	Q	1.5 %	Dec. 30
Cin. & Ham. Trac.	Q	1 %	Jan. 2
Cin. & Ham. Trac., pf.	Q	1.25%	Jan. 2
Cin. & Sub. Bell Tel.	Q	2.5 %	Jan. 2
Col. Ry., Pr. & Lt. Ser. A., pf.	Q	1.5 %	Jan. 2
Detroit Edison	Q	1.75%	Jan. 15
Eastern Mich. Edison	Q	1 %	Jan. 2
El. Lt. & Pr. of A. & R.	S-A	4 %	Jan. 1
Elec. Sec. Corp.	Q	2 %	Dec. 31
Elec. Sec. Corp., pf.	Q	1.25%	Feb. 1
Elec. Stor. Bat.	Q	1 %	Jan. 2
Elec. Stor. Bat., pf.	Q	1 %	Jan. 2
Halifax Elec. Ry.	Q	2 %	Jan. 2
Interstate Rys., pf.	S-A	3 %	Jan 1
Mass. Lt. Co.'s, new	Q	0.25%	Jan. 15
Mass. Lt. Co.'s, old	Q	1.75%	Jan. 15
Mass. Lt. Co.'s, new, pf.	Q	1.5 %	Jan. 15
New Eng. Tel. & Tel.	Q	1.75%	Dec. 31
New York Edison	Q	1.5 %	.....
New York State Rys.	Q	1 %	Jan. 2
New York State Rys., pf.	Q	1.25%	Jan. 2
Ottawa Lt., Ht. & Pr.	Q	2 %	.....
Pac. Tel. & Tel., pf.	Q	1.5 %	Jan. 15
Pub. Service Corp, N. J.	Q	1.5 %	Dec. 31
Puget Sd. Trac., Lt. & Pr., pf.	Q	$1.50	Jan. 15
Reading Trac.	S	1.5 %	Jan. 1
Rep. Ry. & Lt., pf.	Q	1.5 %	Jan. 15
Springfield & Xenia R. R., com.	—	3 %	Dec. 21
Va. Ry. & Pr., pf.	S-A	3 %	Jan. 20
W. Ohio Ry., 1st pf.	Q	1.75%	Jan. 1

Reports of Earnings.

MT. WHITNEY POWER & ELECTRIC.

Income account for year ended November 30, 1914:

	1914	1913
Gross earnings	$651,054	$554,433
Expenses and taxes	274,055	250,275
Net earnings	376,998	304,158
Interest charges	140,764	111,638
Surplus	236,233	192,519

TEXAS POWER & LIGHT.

	1914	1913
November gross	$150,078	$135,748
Net after taxes	57,858	47,774
Surplus after charges	39,781	24,139
12 months' gross	1,581,219	1,172,660
Net after taxes	558,718	439,579
Surplus after charges	319,116	243,375
Balance after preferred dividends	144,428	133,125

FORT WORTH POWER & LIGHT.

	1914	1913
November gross	$81,423	$66,798
Net after taxes	47,045	36,373
Surplus after charges	37,556	29,460
12 months' gross	891,321	648,970
Net after taxes	481,555	378,715
Surplus after charges	376,392	298,088
Balance after preferred dividends	309,659	249,068

CENTRAL STATES ELECTRIC CORPORATION.
(Cleveland Electric Illuminating Company.)

	1914	1913
Net after taxes	165,619	162,008
October gross	$ 337,398	$ 343,003
Balance after interest, preferred dividends and amortization	131,519	128,779
Surplus after depreciation	97,779	94,479
Twelve months' gross	4,246,430	3,907,077
Net after taxes	1,996,094	1,890,146
Balance after interest, preferred dividends and amortization	1,572,335	1,473,870
Surplus after depreciation	1,147,701	1,038,406

CLOSING BID PRICES FOR ELECTRICAL SECURITIES ON THE LEADING EXCHANGES.

	Dec. 21
American Tel. & Tel. (New York)	117¾
Commonwealth Edison (Chicago)	136
Edison Electric Illuminating (Boston)	—
Electric Storage Battery, common (Philadelphia)	49
Electric Storage Battery, preferred (Philadelphia)	49
General Electric (New York)	139¾
Kings County Electric (New York)	120
Massachusetts Electric, common (Boston)	8
Massachusetts Electric, preferred (Boston)	—
National Carbon, common (Chicago)	119
National Carbon, preferred (Chicago)	119
New England Telephone (Boston)	—
Philadelphia Electric (Philadelphia)	23¾
Postal Telegraph and Cables, common (New York)	—
Postal Telegraph and Cables, preferred (New York)	—
Western Union (New York)	57¾
Westinghouse, common (New York)	68½
Westinghouse, preferred (New York)	—

PERSONAL MENTION.

MR. GEORGE C. LEE, of Boston, Mass., has been elected a trustee of the Massachusetts Electric Companies, to fill the vacancy caused by the death of Mr. Gardiner M. Lane. The other trustees are Charles F. Adams, 3d, Charles E. Cutting, Richard Olney and Percy Parker.

MR. W. R. PUTNAM, new business manager of the Utah Light and Power Company, with headquarters at Salt Lake City, is making a trip through the northwest visiting Portland, Seattle, Spokane, and other points for the purpose of studying new business and operating practices of companies in that territory.

MR. E. W. WALLACE, for the past five years in charge of the electric division of the service department of the General Vehicle Company in Boston, has been advanced to a position in the sales department. Mr. Wallace has installed more than 200 electric vehicles in New England, and is widely known among users of this type of transportation agency.

MR. CHARLES S. CLARK, secretary of the Massachusetts Street Railway Association, was presented with a gold watch and a book *de luxe* containing verses and cartoons cleverly done by Mr. H. A. Faulkner, president of the New England Street Railway Club, and touching upon Mr. Clark's activities in humorous vein, at a meeting of the Association in Boston, December 17.

MR. H. M. DINGLEY, who for a long time has been prominent in the electric lighting and power business, as well as in woolen manufacturing, in Lewiston, Me., has recently turned over to the heirs of his partner, the late W. Scott Libbey, his interests in the firm of Libbey & Dingley, which began its successful career 28 years ago. The firm controlled the Lewiston & Auburn Electric Light Company, which was recently sold to the Androscoggin Electric Company. The Portland & Lewiston Interurban Railway was also one of its properties.

MR. H. THURSTON OWENS, until recently secretary and general manager of the San Diego (Cal.) Gas and Electric Appliance Company, has become associated with the lighting fixture house of Bayley & Sons, 101 Park Avenue, New York City. Mr. Owens has been in the lighting business for 15 years, with the Consolidated Gas Company, the city of New York, and the La Crosse (Wis.) Gas and Electric Company. He has been actively identified with the work of a number of gas and electric associations and a frequent contributor to the trade papers.

MR. GEORGE M. COX, for some time acting general manager of the Middlesex & Boston Street Railway and of Norumbega Park, has been chosen vice-president and general manager of the two companies, whose offices are at Newtonville, Mass. Mr. Cox began his career with the Newton Street Railway Company as bookkeeper and has risen through the positions of chief clerk, assistant treasurer and acting general manager. The Newton Street Railway now forms a part of the Middlesex & Boston system, which is the fifth largest street railway system in Massachusetts and operates 130 miles of track. Mr. Cox has been an alderman in Newton and president of the Newton Catholic Club. He is a member of the New England Street Railway Club and a number of other organizations.

MR. JAMES E. ALLISON has been appointed lecturer in economics at Washington University. He will deliver a course of lectures under the general direction of the Department of Economics, dealing with the principles underlying the regulation of public utilities. In order to encourage the study of economics by students of engineering of Washington University, Mr. Allison has established a fund to be known as "The Allison Fund," the annual income of which is to be used either for awarding cash prizes or in such manner as, in the opinion of the Dean of the School of Engineering and the head of the department of Economics, will best promote the object of the fund. Mr. Allison was recently chief engineer of the St. Louis Public Service Commission.

OBITUARY.

MR. JOHN JACOB MYER, a salesman for the American Circular Loom Company, covering New England territory; where he was well known among electrical men as "Bill" Myer, died December 13 in Boston, Mass. He was a native of Maryland, and about 50 years of age. For a time he was Texas representative of the Columbia Incandescent Lamp Company.

MR. DON C. TIFFANY, head of D. C. Tiffany & Company, proprietors of an electric garage and New England agents for the Ohio Electric Car Company, with headquarters in Boston, Mass., died at his home in Watertown, Mass., December 18, at the age of 31 years. Mr. Tiffany came from Maine to Boston, where he built up an extensive electric automobile business. He was active in the Electric Motor Car Club of Boston. His wife and two small children survive him.

GENERAL THOMAS SHERWIN, chairman of the board of directors of the New England Telephone and Telegraph Company, died on December 19 at his home in Boston, after an illness of several weeks. General Sherwin was born in Boston in 1839, and was graduated from Harvard. He served with distinction in the Civil War. In 1864 he was made a colonel of volunteers "for gallant services at the battle of Peebles Farm, Va.," and the following year was made a brigadier-general "for distinguished gallantry at the battle of Gettysburg and for gallant and meritorious services during the war." Since the close of the war he had been engaged in business in Boston and was connected with many New England corporations.

DATES AHEAD.

American Association for the Advancement of Science. Annual meeting, Philadelphia, Pa., December 28, 1914, to January 2, 1915. Secretary, L. O. Howard, Washington, D. C.

Electrical Contractors' Association of the State of Illinois. Semi-annual meeting, Chicago, Ill., January 15-16, 1915. Secretary, E. J. Burns, Rock Island, Ill.

Electrical Contractors' Association of Wisconsin. Annual meeting, Milwaukee, January 18-20, 1915. Secretary, Albert Petermann, Milwaukee, Wis.

Independent Telephone Association of America. Annual convention, Hotel Radisson, Minneapolis, Minn., January 19-21, 1915. Secretary, W. S. Vivian, 19 South LaSalle Street, Chicago, Ill.

American Wood Preservers' Association. Annual convention, Congress Hotel, Chicago, Ill., January 19-21, 1915. Secretary, F. J. Angier, Baltimore, Md.

Wisconsin Electrical Association. Annual convention and joint meeting with Wisconsin Gas Association, Hotel Pfister, Milwaukee, January 20-22, 1915. Secretary, George Allison, First National Bank Building, Milwaukee, Wis.

Northern White Cedar Association. Nineteenth annual meeting, Minneapolis, Minn., January 26-27, 1915. Secretary, N. E. Boucher, Minneapolis.

Western Association of Electrical Inspectors. Annual meeting, Hotel Radisson, Minneapolis, Minn., January, 26-28, 1915. Secretary, W. S. Boyd, Chicago.

With the Electrical Manufacturers

Gould Storage Battery Company has removed its Detroit, Mich., office to the Kerr Building, 100 Beaubien Street.

The Stow Manufacturing Company, Binghamton, N. Y., has ready for distribution Bulletin No. 400, illustrating and describing a complete line of portable tools.

The Reynolds Electric Company, 422 South Talman Avenue, Chicago, announces that the Court of Appeals has "affirmed the lower court in a decision handed down on December 6, 1914, sustaining all of the legal rights relating to Reco color hoods."

American Manufacturers' Agency, 111 West Monroe Street, Chicago, of which William H. McKinlock is president, has taken the agency for the Burnley Battery & Manufacturing Company's products in the line of soldering salts, sticks and pastes.

The Kuhlman Electric Company, Elkhart, Ind., on December 20 completed its twentieth year in the transformer business. The company was organized by E. Kuhlman, who is still at the head of the business. Mr. Kuhlman is an enthusiastic Jovian. His potential is number 44; he was one of

the charter members of the Jovian order.

Archbold-Brady Company, Syracuse, N. Y., has issued an attractively illustrated booklet on steel transmission structures and catenary bridges. Over 50 types of towers and bridges are shown, also several views showing shipment and erection of typical structures. Each illustration is briefly described. The pictures are made by the new photogravure process, which gives a very pleasing aspect to the pages.

The C. & E. Electric & Manufacturing Company, Garwood, N. J., announces that its Cincinnati office, in charge of F. A. Saylor, has been removed from the Greenwood Building to 217 West Second Street. Considerably more space has been provided in the new location to permit the carrying of a comparatively large stock, so that shipments can be made direct without waiting to receive material from the factory at Garwood.

Horton Manufacturing Company, Fort Wayne, Ind., announces that it has appointed M. J. Riding as sales manager of its electrical department. The Horton company manufactures an electric washing machine that is extensively in use. Mr. Riding is well known to the electrial trade, having been with the Horton company for some time. The company has elaborate plans for enlarging its dealers' cooperative service, the details of which will soon be announced.

Robbins & Myers Company, Springfield, O., has appointed C. R. Hunt and Guy H. Gibbs to take charge of its exhibits at San Francisco and San Diego respectively. Mr. Hunt has for the past five years been district wiring specialist of the Chicago office of the General Electric Company. Previous to this time he was connected with the Crocker-Wheeler, Switchboard Equipment and Cutler-Hammer Manufacturing Companies. Mr. Hunt is a native of California and a graduate of the University of California. At the close of the Panama-Pacific Exposition he will maintain a permanent office in San Francisco. Mr. Gibbs has for the past five years been connected with the Western Electric Company as power equipment specialist at its Cincinnati and Buffalo offices. Previous to this he was for eight years connected with the Westinghouse company at its Philadelphia and Cincinnati offices. During the years from 1896 to 1901, before making his connection with Westinghouse, Mr. Gibbs was a manufacturers' agent in Great Britain and on the continent of Europe. The company has moved its New York office to 30 Church Street.

The Cutler-Hammer Manufacturing Company, Milwaukee, Wis., has ready for distribution a booklet on its new line of magnetic switches. This new line includes the magnetic lockout switch of the series-coil-operated type, the redesigned line of shunt-coil-operated switches, and spring-coiled switches for dynamic-brake service. The magnetic lockout switches are for automatic motor-starting purposes, the switches having the characteristic of remaining open when the current is excessive and closing when the current falls below a predetermined value. The spring-closed switches are used in order to keep the dynamic-brake circuit closed when the operator's master controller is in the off position, without the necessity of keeping a switch coil continuously energized. In case of failure of voltage this type of switch also insures keeping the dynamic-braking circuit closed. The booklet describes the operation of these switches fully.

Record of Electrical Patents.

Issued by the United States Patent Office, December 15, 1914.

1,120,668. Flash-Lamp Attachment for Electric Batteries. F. Basedow, Chicago, Ill. Lamp supporting and connecting bracket mounted on binding-posts.

1,120,677. Time-Controlled Apparatus. W. A. Blanchard, Lawton, Okla. For operating the push-button of an electric switch.

1,120,708. Current-Controlling Apparatus. E. L. Gale, Sr., assignor to Otis Elevator Co., Jersey City, N. J. Automatic motor-starter.

1,120,709. Automatic Starter for Electric Motors. E. L. Gale, Sr., assignor to Otis Elevator Co. Modification of above.

1,120,710. Photographic Apparatus. E. Goldensky and P. H. Bartlett, Philadelphia, Pa. An electromagnetic switch for changing lamps from series to parallel is operated simultaneously with the camera-shutter.

1,120,712. Contact-Making Mechanism. C. I. Hall, assignor to Chicago Electric Meter Co., Chicago, Ill. Ratchet-controlled tripie-spring arrangement for maximum-demand meter.

1,120,728. Electric Brake. W. D. Lutz, assignor to Otis Elevator Co. Relates to spring and toggle mechanism.

1,120,731. Conduit or Pipe and Process of Treating the Same. P. McIlroy, assignor to Enameled Metals Co., Sharpsburg, Pa. The exteriorally threaded end is provided with a fragile protecting sleeve to which is applied a protecting coating extending over to the conduit.

1,120,748. Holder for X-Ray Tubes. E. N. Ryder, Brewster, N. Y. Adjustable bracket to permit directing the rays in different directions.

1,120,750. Reflector. E. S. Slocum, Chicago, Ill. Shallow indirect-fixture bowl with conical rim and spherical center, the lamps being held at the junction of the two surfaces.

1,120,758. Hot-Meal Server. C. Stirn, San Francisco, Cal. Has an electric heater near the bottom of the receptacle.

1,120,769. Lamp Attachment for Firearms. O. F. Vilarejo, Milwaukee, Wis. Battery in handle and lamp in front of trigger.

1,120,773. Combined Toilet Mirror and Lamp. W. E. Ward, Bayonne, N. J. Adjustable portable outfit.

1,120,781. Thermoelectric Heating and Cooling Body. W. W. E. Altenkirch, Fredersdorf, and G. R. Gehlhoff, Danzig-Langfuhr, Germany. Has several concentric thermocouples, the hot joint of one being adjacent the cold joint of another couple.

1,120,794. Rubber-Covered Article and Method of Making the Same. L. Daft, Rutherford, N. J., assignor to Electro-Chemical Rubber & Mfg. Co. Consists in electrodepositing antimony on the surface of the metal and vulcanizing rubber over the deposit.

1,120,795. Rubber-Coated Metal Article and Method of Producing the Same. L. Daft, assignor to Electro-Chemical Rubber & Mfg. Co. Modification of above.

1,120,805. Circuit-Closing Mechanism. T. Gibson, G. A. Farmer and E. Read, Burton-upon-Trent, England. Double steel spring track ramp.

1,120,811. Coil-Insulating Device. E. Haefely, assignor to Westinghouse Electric & Mfg. Co. Comprises a hollow pressure tube, supporting brackets and spring boxes connecting the brackets.

1,120,813. Electric Railway Signaling Device. F. S. Hart, Dayton, O. Motor-operated danger lamp and indicator.

1,120,829. Circuit Connection for Electrical Apparatus. P. MacGahan, assignor to Westinghouse Electric & Mfg. Co. Terminal block with tubular leading-in conductor that projects into the block.

1,120,830. Electric Water-Heater. J. Mann, London, England. Helical tubular coil with resistance wire wound over its surface.

1,120,846. Relay. H. A. Parrish, Kalamazoo, Mich., assignor of one-tenth to G. E. Dunbar. Includes two pairs of electromagnets actuating a pawl.

1,120,849. Moisture-Proofing and Moisture-Proofed Telephone and Switchboard Cord Conductor. A. Pruessman, assignor to Western Electric Co. The fibrous covering for the wires is saturated with an insulating compound.

1,120,850. Electrical Measuring Instrument. A. B. Reynders, assignor to Westinghouse Electric & Mfg. Co. High-potential oil-immersed electrostatic voltmeter.

1,120,851. Holder for Electric Glow-Lamps. C. A. Schaefer, Hanover, Germany. Fixture with vertically adjustable socket.

1,120,884. Electrically Heated Culinary Apparatus. J. I. Ayer, assignor to Simplex Electric Heating Co., Cambridge, Mass. Clamps the vessel to the disk stove.

1,120,927. Dimmer for Electric-Lamp Bulbs. C. E. Godley, assignor to Edmunds & Jones Mfg. Co., Detroit, Mich. Diffusing glass cap placed over bulb in automobile headlight.

1,120,949. Controlling Means for Vapor Apparatus. P. C. Hewitt, assignor to Cooper Hewitt Electric Co., Hoboken, N. J. Rectifier with electrode shield.

1,120,951. Manufacture of Insulators for High-Potential Electric Conductors. M. Locke, Victor, N. Y. The porcelain base has a boron compound in its composition.

1,120,964. Therapeutic Apparatus. J. H. Neel, Los Angeles, Cal. Magnetic cabinet with powerful electromagnets on opposite sides thereof.

1,120,966. Electric Heat-Radiator. A. B. Neiman, assignor to Neiman Heater Co., New York, N. Y. The heating coils are inclosed in tubes with flanged radiating plates.

1,120,971. Electric Sign. W. K. Queen and T. F. Pickett, Needham Heights, Mass. Commutator for connecting the lamps in different combinations.

1,120,982. Exhibiting Device. H. D. Schroeder, Los Angeles, Cal. Display curtain driven by reversing motor.

1,120,984. Static Collecting and Discharging Mechanism. J. S. Thompson, Chicago, Ill. Device for removing static electricity from printing paper.

1,120,987. Heating Device. F. M. Vogel, assignor to General Electric Co. Heat-insulated oven with rotatable electrically heated storage mass.

1,120,992. Neutralizing Inductive Disturbances. E. F. W. Alexanderson, assignor to General Electric Co. Single-phase railway with series transformers between trolley and return cable, latter being connected to rails through reactive bonds.

1,120,995. Signaling System. C. E. Beach, assignor to G. O. Knapp, New York, N. Y. Fire-alarm system in which central office is affected by large current changes only while local engine houses are affected by small current change.

1,120,997. Electromagnetic Selective Device. W. S. Burnett, assignor to Morse Code Signal Co., Milwaukee, Wis. Step-by-step selector at each substation.

1,121,002. Mining Machine. C. E. Davis, assignor to Goodman Mfg. Co., Chicago, Ill. Motor-operated and propelled coal-mining machine.

1,121,014. Electrical Apparatus. H. M. Hobart, assignor to General Electric Co. The core of the turbogenerator is intermittently moistened and a current of air is continually blown on the moist surface.

1,121,025. Ignition System. L. Krieger, assignor to General Electric Co. Special interrupter in primary of induction coil.

1,121,065. Method of and Apparatus for Preventing Sparking in Dynamo-Electric Machines. B. J. Boicourt, Colorado Springs, Colo., assignor to C. & C. Electric & Mfg. Co. D. C. machine with both main and auxiliary commutating coils on the inter-poles.

1,121,067. Electric Bell. S. C. Bryant, Chicago, Ill., assignor to Bryant Zinc Co. Relates to striking and current-interrupting mechanism of gong.

1,121,074. Electric Heater. H. W. Denhard, assignor to Cutler-Hammer Mfg. Co. Water heater with opposite electrodes arranged parallel, like those of a storage battery.

1,121,077. Electrode Device for High-Frequency Apparatus. W. Dubilier, Brooklyn, N. Y. Sparking electrode projecting into hollow cup.

1,121,090. Electric Door-Opener. M. Guett, assignor to Hart & Hegeman Mfg. Co., Hartford, Conn. Electromagnetic release.

1,121,104. Combination Horn. J. W. Jones, New York, N. Y., assignor to Lovell-McConnell Mfg. Co. Electromagnetically actuated diaphragm horn for automobile.

1,121,121. Apparatus for Indicating a Fair Charge for Electrical Current Consumed. E. T. R. Murray, Radlett, England. Flat-rate controller and current interrupter with adjustable maximum demand.

1,121,124. Alarm System. L. A. Northrup, San Francisco, Cal. Electrically controlled audible and visual signals.

1,121,138. Stop Mechanism. W. H. Schoonmaker, Montclair, N. J. Electromagnetic stop for phonograph.

1,121,196. Light-Reflecting Device. E. C. McKinnie, assignor to National X-Ray Reflector Co., Chicago, Ill. Portable table or floor lamp with open-bottom reflector about upper part of bulb to throw light on ceiling and diffusing bowl about lower part of bulb to illuminate art shade.

1,121,242. Electric Table-Lamp. R. S. Giese, Pittsburgh, Pa. Base, stand and globe are made of one piece of glass. (See cut.)

1,121,247. Incandescent - Electric - Lamp Support. H. H. Hirsch, Philadelphia, Pa. For mounting safety lamp on miner's cap.

1,121,248 and 1,121,249. Portable Electric-Lighting Apparatus. H. H. Hirsch. Miner's electric safety lamp with inner reflector and outer protecting casing, each connected so as to open-circuit or short-circuit the lamp when casing is crushed.

1,121,254. System for Operating Railroad Traffic. J. W. Kammer, New York, N. Y. Electric block-signal and control system.

1,121,283. Translating Device for Railway Signaling. H. D. Patterson, Mount Vernon, N. Y. Electromagnetic signal actuated from A. C. signal circuit through transformers with double primary.

1,121,288. Combined Plug-Switch and Fuse. F. J. Ravlin, Chicago, Ill. Double-chambered housing with fuses in upper chamber and plug socket in lower one.

1,121,291. Outlet or Switch Box. M. Robinson, Newton, Mass. Has special knockouts and elliptical wire openings to hold insulating loom.

1,121,292. Electric-Light Flasher. M. C. Ryan, Phoenix, N. Y. Thermostatic switch in lamp base.

1,121,293. Magnetic Lamp-Support. J. Sachs, assignor to Hart & Hegeman Mfg. Co., Hartford, Conn. Mounted in a single case is a battery, electromagnetic holding coil with core in the base, lamp, reflector and switch.

1,121,329. Electric-Light Attachment for Levels. B. E. Curtis, Bangor, Me. Includes battery, switch and a lamp for each bubble.

1,121,341. Electric Radiator-Heater. R. Farren and C. T. Clark, Cleveland, O. Electric heating units in the lower and a special lateral connecting pipe.

1,121,347. Secondary Electric Clock. F. Geiger, Duluth, Minn. Electric escapement.

1,121,348. Electric-Lamp Socket. G. W. Goodridge, assignor to Bryant Electric Co., Bridgeport, Conn. Notched latching joint between cap and shell.

1,121,350. Distributing Box. W. B. Greene, assignor to Adapti Mfg. Co., Cleveland, O. The body has side sections cut away to receive interchangeable angle and other fittings secured thereto by screws. (See cut.)

1,121,356. Telephone System. J. Harrison, Glendale, Mo. The main station has a sounder and an annunciator.

1,121,358. Vapor Electric Translating Device. P. C. Hewitt, assignor to Cooper Hewitt Electric Co., Hoboken, N. J. Mercury-vapor apparatus with two long, parallel tubes connected at the ends where electrodes are located.

1,121,359. Controlling Means for Vapor Apparatus. P. C. Hewitt, assignor to Cooper Hewitt Electric Co., Hoboken, N. J. The method of increasing the resistance at starting consists in inducing at the electrode a normal charge and also a charge from a separate source.

1,121,360. Apparatus for Transforming Electrical Energy. P. C. Hewitt, assignor to Cooper Hewitt Electric Co. Periodic discharge gap or interrupter for a capacity circuit including a mercury-vapor device.

1,121,361. Vapor Electric Apparatus. P. C. Hewitt, assignor to Cooper Hewitt Electric Co. Has several tubes depending from the main bulb and each containing a positive electrode.

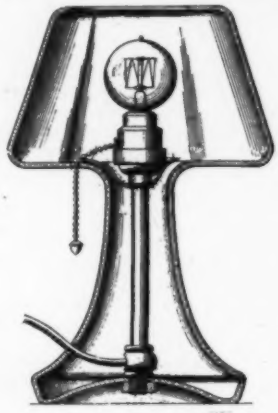
1,121,368. Metallic-Filament Lamp. H. J. Jaeger, Weehawken, N. J. Has two filaments, one of high and the other of low candlepower.

1,121,373. Machine for Abrading and Polishing Floors. P. Keneder, assignor to E. Zentz, Munich, Germany. Motor-driven.

1,121,374. Cap for Lamp-Sockets, Pendant-Switches, and other Electrical Devices. C. J. Klein, assignor to Cutler-Hammer Mfg. Co. Insulating lining and method of holding it.

1,121,379 to 1,121,382. Electrically Propelled Vehicle. H. W. Leonard, Bronxville, N. Y. First three patents relate to a vehicle with internal-combustion engine, generator, storage battery and driving motors. According to fourth patent all four driving wheels have independent motors.

1,121,400. Automatic Telephone Calling Device. P. Richardt, assignor to Zivnostenska Banka, Prague, Austria-Hungary. Includes a selector and clockwork mechanism controlled by the movement of the receiver arm.



No. 1,121,242.—One-Piece Glass Lamp.

1,121,404. Stopping Apparatus for Motor-Cars. H. C. Ruf, Easton, Pa. Includes electromagnetic valve for fuel supply.

1,121,409. Process for Removing Liquid from Organic and Inorganic Substances. B. Schwerin, assignor to Elektro-Osmose Aktiengeselischaft, Berlin, Germany. Process for removing water from peat consists in subdividing the peat finely in presence of sodium hydrate and subjecting it to electroosmotic treatment.

1,121,416. Automatic Electric Gas-Drip Alarm Device. C. H. Stevick, Astoria, N. Y. When water rises in cup to certain point it closes alarm circuit.

1,121,420. Operating Means for Electric-Lamp Switches. A. J. Tizley, assignor to Edward F. Caldwell & Co., New York, N. Y. Switch operated by rotation of electric candle base.

1,121,424. Signaling Apparatus for Vehicles. W. M. Voss, Tampa, Fla., assignor of one-half to F. J. Cortina. Solenoid-operated and electrically lighted direction pointer.

No. 1,121,350.—Conduit Box with Interchangeable Attachments.

1,121,438. Mail-Delivering Apparatus. F. S. Whitmore, Waynesboro, Pa. Motor-driven mail box traveling on overhead two-conductor track.

1,121,444. Electric-Wire Conduit for Buildings. L. Adler, New York, N. Y. Conduit of elliptical cross section and open on one of its narrow sides with U-shaped brackets for closing the open side by compressing the conduit.

1,121,479. Transformer. E. L. Colby, Auburn, N. Y. Has an adjustable winding adapted to be connected in series with either primary or secondary.

1,121,520. Pole. A. H. Matthew, Colville, Wash. Metallic tubular line pole with means for supporting metal crossarm.

1,121,539. Cigar-Lighter for Attachment to Automobiles and the Like. M. C. Schwab, Chicago, Ill. Electric cigar-lighter with solenoid for raising it to convenient position on steering rod.

1,121,540. Electric Recording Instrument. A. L. Sohm and C. L. Adams, assignors to Sohm Electric Signal & Recording Co., Spokane, Wash. Mechanism for printing on a time slip.

1,121,542. Ventilator. W. F. Wegner, Chicago, Ill. Electric fan and means for directing its breeze.

1,121,544. Control System. N. Wilkinson, assignor to Allis-Chalmers Mfg. Co. Field rheostat with means for keeping the field circuit closed when cutting off supply.

1,121,545. Dynamo-Electric Machine. R. B. Williamson, assignor to Allis-Chalmers Mfg. Co. U-shaped spacing device between the core plates.

1,121,561. Advertising Device. H. J. Keating, Chicago, Ill. Includes a plunger reciprocating between two solenoids.

1,121,562. Selective Signaling System. O. T. Lademan, assignor to Morse Code Signal Co., Milwaukee, Wis. Includes a step-by-step signal-receiving, and answer-back device.

1,121,563. Means for Automatically Steering Torpedoes or the Like. K. O. Leon, assignor to Leon Steering Device Co., Brooklyn, N. Y. Includes a gyroscope that can be disconnected from steering mechanism through wireless receivers.

1,121,567. Motor-Starter. A. C. McWilliams, Chicago, Ill. Automatic starting switch for induction motor.

1,121,568. Fixture-Support. A. C. McWilliams. For electric light fixtures; consists of hanging bar supported through wedge slot from cross bar.

1,121,574. Circuit-Interrupter. C. Aalborg, assignor to Westinghouse Electric & Mfg. Co. High-tension oil line switch with a series of pairs of contacts having low-resistance shunts.

1,121,575. Culinary Apparatus. T. Abtmeyer, assignor to Westinghouse Electric & Mfg. Co. Electric frying pan that can be inverted on stand and used as disk stove.

1,121,577. Semi-Indirect-Lighting Fixture. H. C. Adam, St. Louis, Mo. Has translucent diffusing bowl hanging from annular reflector having shallow double-cone section.

1,121,585. Portable Mirror. A. Z. Hirsch, San Francisco, Cal. Has electric lamp at end of arm adjustably pivoted at center of back of mirror.

1,121,586. Releasing Device for Organ Stop-Keys. R. Hope-Jones, North Tonawanda, N. Y.; C. Hope-Jones, administrator of said R. Hope-Jones, deceased. Electrically operated release.

1,121,593. Alarm Mechanism for Distribution Systems. J. D. Nelson, Cincinnati, O. Variations of pressure in pipe actuate electric alarm.

Patents Expired.

The following United States electrical patents expired December 21, 1914:

595,695. Electric Accumulator. C. P. F. Clerc and A. G. Pingault, Paris, France.

595,712. Electric Furnace. J. E. Hewes, Philadelphia, Pa.

595,731. Electric Motor. M. B. Pengnet, Cambridge, Mass.

595,768. Electric Controlling Device for Paper-Feeding Machines. T. C. Dexter, Pearl River, N. Y., and C. Ransom, Jersey City, N. J.

595,777. Electric Switch. H. F. Kleinschmidt, Hamburg, Germany.

595,803. Automatic Switch for Electrical Apparatus. S. L. Barrett, New York, N. Y.

595,821. Method of and Apparatus for Multiple Metering of Electric Currents. E. Oxley, Washington, D. C.

595,841. Electric Meter. W. S. Weston, Chicago, Ill.

595,868. Reversing and Cutting-Out Switch for Electric Motors. T. von Zweigbergk, Cleveland, O.

595,871. Electric Burglar and Fire Alarm. C. J. Bukouts, Lamoille, Ill.

595,887. High-Tension Switch. H. Muller, Nuremberg, Germany.

595,874. Electric Elevator. A. L. Duwelius, Cincinnati, O.

595,898. Electric Motor. F. E. Whipple and C. A. Stauffer, Philadelphia, Pa.

595,901. Electrical Musical Instrument. G. A. Brachhausen, Rahway, N. J.

595,911. Electric Clock. S. Fischer, New York, N. Y.

595,936. Electric Arc Lamp. A. Blahnik, Paris, France.

595,963. Electric Burglar-Alarm. D. W. McCaughey, Chicago, Ill.

596,002. Electrical Transmission of Energy. R. M. Hunter, Philadelphia, Pa.

596,012. Prepayment Coin - Controlled Mechanism for Electric Meters. W. F. Browne, New York, N. Y.

596,017. Telephony and Telegraphy. M. Hutin and M. LeBlanc, Paris, France.

596,036. Auxiliary Apparatus for Selective Electrical Signals. G. W. Whittemore, Brooklyn, N. Y.

596,041. Electrical Transmission of Energy. R. M. Hunter, Philadelphia, Pa.